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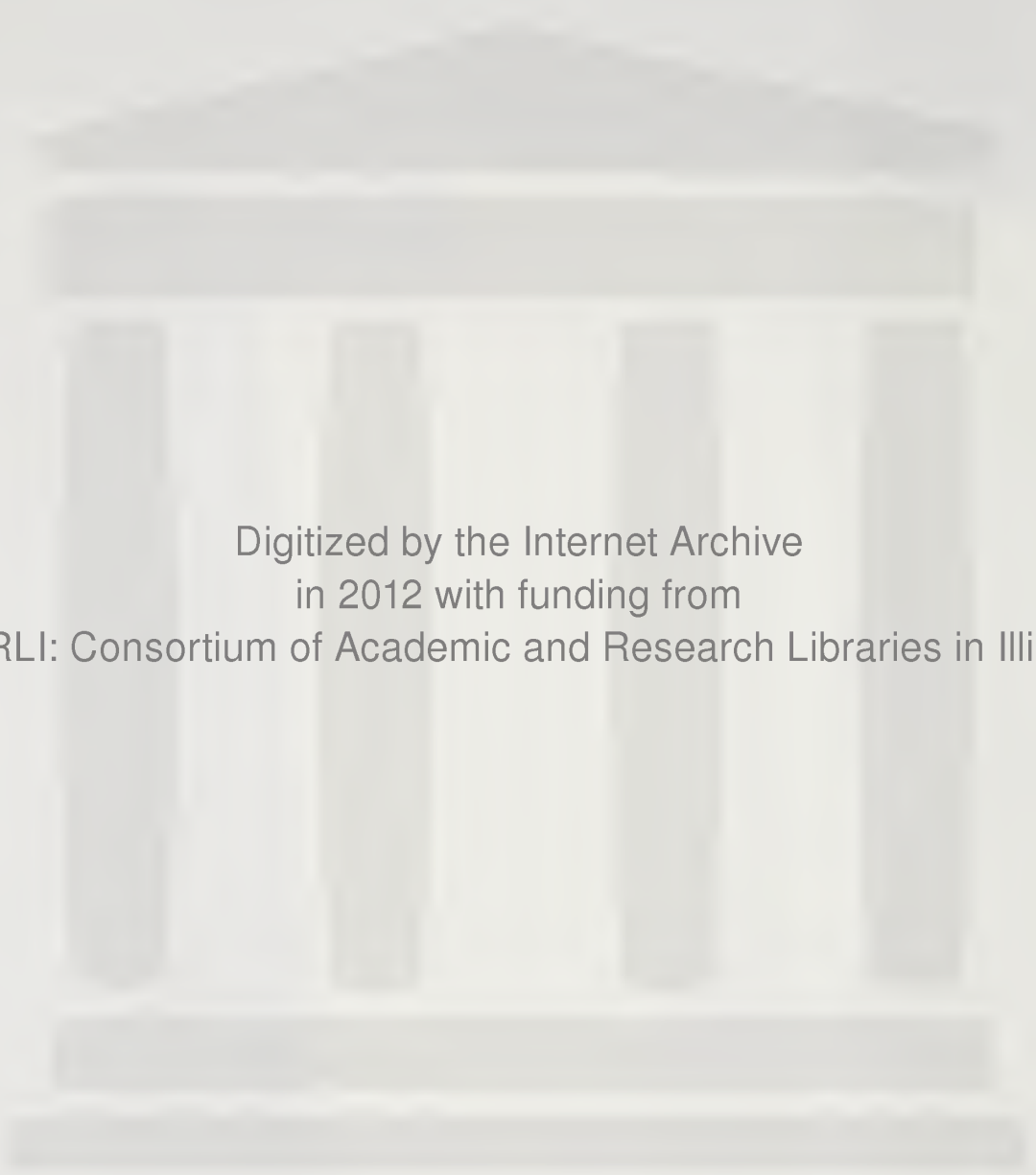
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ASSESSMENT - METHODS: GENERAL ENVIRONMENTAL

A FIELD STUDY OF SELECTED FAUNA FOR THE COALCON CLEAN
LIQUID BOILER FUELS DEMONSTRATION PLANT SITE

NEW ATHENS, ILLINOIS

by

Mary Ellen Hardin
Daniel R. Kostelc
Bruce G. Peterjohn
John Casson
James W. Hardin
Willard D. Klimstra

September 30, 1976

Submitted by

W. D. Klimstra, Director
J. W. Hardin, Assistant Director
Cooperative Wildlife Research Laboratory
Southern Illinois University
Carbondale, Illinois

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INTRODUCTION

Reclamation following surface mining has the potential of providing unique habitats for a variety of wild animals. Klimstra (1959) found that populations frequently were equal to, if not better than those on unmined farmland, suggesting that strip-mined areas have a potential for wildlife management. Other authors (Bookhout et al. 1968, Jones 1967, Karr 1968, Riley 1954, Urbanek 1976) found larger populations of some vertebrates on strip-mined than on unmined land.

Intensive studies of vertebrate populations on mined lands are limited; however, mammal surveys on strip-mined land in Perry County, Illinois have been conducted (Arata 1959, Verts 1957, 1959). These studies compared land mined during 1932-1950 with about 150 acres of unmined land. On these areas, 25 species of mammals were recorded, 8 of which were distributed uniformly over the area. Yeager (1940, 1942) noted that at least 22 mammal species used strip-mined land in central Illinois. He suggested that these lands might provide a refuge for wildlife in more intensively farmed prairies.

On strip-mined land in southern Indiana, Jones (1967) documented 28 species of mammals; Sly (1976) contributed information on small mammal succession. Kirkland (1976) determined diversity and distribution of small mammals on mine wastes in New York and Bookhout et al. (1968) and DeCapita and Bookhout (1975) examined mammals on mined and unmined areas in southeastern Ohio. Riley (1954), evaluating mammals on Ohio strip-mined land, found some species more abundant on mined areas. He concluded that mined land was not better habitat nor was it as diverse as unmined land.

Many authors have recorded the avifauna of Illinois (Bennett 1952, Cory 1909, Eifert 1941, Forbes and Gross 1923, George 1968, Graber and Graber 1963, Kleen and Bush 1971, Pettingill 1951, Ridgway 1889, 1895, Smith and Parmalee 1955). Graber and Graber (1963) reported 132 species (116 in summer and 68 in winter) during bird censuses in southern Illinois. In contrast, George (1968) recorded 264 regular and 25 accidental species in the 38 southernmost counties; Kleen and Bush (1971) yielded similar results (256 regular and 20 accidental) for the 11 southernmost counties.

Although there has been limited study of the avifauna of strip-mined lands, in some areas studied it appears that greater diversity and abundance of some birds occurred on reclaimed striplands compared to cropland and abandoned farmlands (Riley 1954, Vohs and Birkenholz 1962, Yeager 1940). Eighty-nine species of birds were found on 6- to 24-year-old striplands in Perry County; 44 species bred on the area and, nearly all were forest-edge birds on sites 14-17 years old (Brewer 1958, Verts 1956). Jones (1967) observed 139 species of birds on strip-mined land in Indiana; and, Urbanek (1976) reported 124 species on stripland and 129 species on unmined land in Williamson and Saline counties, Illinois. Of those on mined lands, 80 were potential breeding species. Striplands and a woodland in east-central Illinois had higher breeding bird populations than those in similar habitats in eastern North America due to the presence of water and ridge-and-valley topography (Karr 1968).

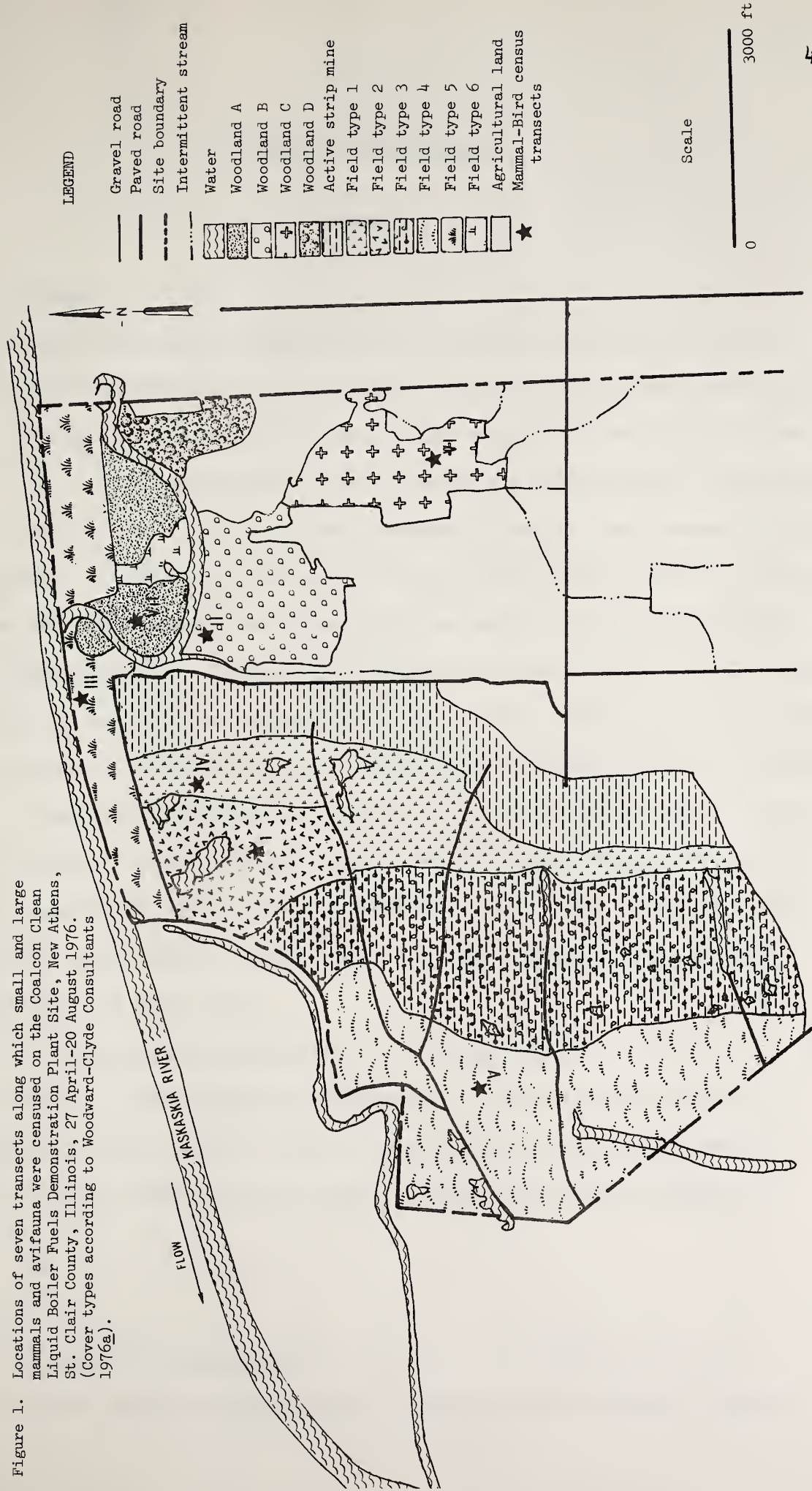
As part of an environmental assessment for the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, mammalian and avian fauna were systematically sampled. Objectives of this study were to determine: (1) diversity and distribution of mammalian fauna, (2) density and diversity of avifauna, and (3) impacts of construction of the demonstration plant on these species.

Study Area

The study area consisted of recently strip-mined land, unmined woodlots, and the active mining site of the Delta River Mine Number 3 of Peabody Coal Company, New Athens, St. Clair County, Illinois. The area was bordered on the north by the channelized Kaskaskia River, on the south and east by agricultural land, and on the west by the town of New Athens.

Woodland and field types were determined from a cover map (Fig. 1). An oxbow of the Kaskaskia River crossed the eastern portion of the area and surrounded woodland A, a bottomland forest. Woodlands B and C were upland forests. Four field types were sampled; three had been reclaimed recently. Field types 1 and 2 had been planted in legumes, many weedy species had invaded; field type 4 was planted primarily in grasses (Festuca sp.) and legumes. Field type 5 was located along the Kaskaskia River and had not been mined. Vegetation was dense and consisted of numerous saplings and annual weeds.

Figure 1. Locations of seven transects along which small and large mammals and avifauna were censused on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 27 April-20 August 1976. (Cover types according to Woodward-Clyde Consultants 1976a).



MATERIALS AND METHODS

Mammals

Small Mammals

Trap stations were located at 25-foot intervals along each of the 1,000-foot transects (Fig. 1) to collect insectivores and small rodents. At each station, two Museum Special snap traps were placed about one foot to each side of the transect with a Victor mouse trap between them. Traps were set at ground level under herbaceous vegetation and in small mammal runways to increase likelihood of capture, and were baited with a mixture of peanut butter and rolled oats. Ten sunken, 5-pound metal cans, partially filled with water, were placed along each transect at 100-foot intervals to sample mammals too small to be captured in the snap traps. All traps were checked and rebaited for three consecutive days during 6-18 May 1976 and 2-8 August 1976. Specimens captured were labeled as to habitat type, transect, date, and collector, and were frozen. Representative study skins were placed in the Cooperative Wildlife Research Laboratory collection, Southern Illinois University, Carbondale. Nomenclature and identification were based on Hoffmeister and Mohr (1972).

To compare mammal populations, results were based on "captures per 100 trap-nights." Trap-nights were the number of 24-hour periods sampled, multiplied by the number of traps set; thus each transect was trapped for three 24-hour periods with 120 traps, resulting in 360 trap-nights per transect.

Bats

During both trapping periods, 8-foot X 40-foot nylon mist nets were erected on five evenings at pond edges and along potential flyways

created by physical features of the habitat. Also, an abandoned house located near an oxbow of the Kaskaskia River between transects II and VII was examined, and a mist net erected to capture any bats flying around the building. Animals captured were identified and subsequently released; two specimens transported to Carbondale for marking were released unharmed at the point of capture the following evening.

Large Mammals

Large mammals were censused along each transect between dusk and dawn on two occasions during each trapping period. Each transect was traversed while recording all mammals seen and all evidence of their activities, based on occurrence of dens, tracks, droppings, or signs of feeding. No specimens were collected. In addition, during 27 April-20 August 1976, notes were maintained on all mammals observed in areas other than along transects. Hoffmeister and Mohr (1972) and Burt and Grossenheider (1964) served as references for identification and nomenclature of specimens; Murie (1975) was used for identification of animal tracks.

Birds

The avifauna was sampled during 19 May-1 June 1976 and 10-19 August 1976 along the seven 1,000-foot transects (Fig. 1). Species and numbers of birds observed or heard within a belt 100 feet wide in woodlands and 150 feet wide in fields were recorded. Each transect was censused twice a day on three nonconsecutive days from 0600-1025 hours. The data collected were used to determine the density of birds along each transect as follows:

- 1) square feet of habitat type = length (ft.) of each transect
X width (ft.) censused X number of times each transect was
sampled.
- 2) number of acres sampled = $\frac{\text{square feet of each habitat type}}{43,560 \text{ square feet/acre}}$
- 3) birds per acre = $\frac{\text{number of birds in each habitat type}}{\text{number of acres sampled in each habitat type}}$

Additional areas on the study site were examined for species not found on the transects. For observation, 7 X 35 mm binoculars were used. Identification was according to Robbins et al. (1966), and nomenclature was based on the American Ornithologists' Union Check-list (Am. Ornith. Union 1973).

Table 1. Relative abundance of small mammals captured during 6-18 May 1976 on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois. Trapping results are expressed as captures per 100 trap-nights.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Soricidae							
<u>Blarina brevicauda</u> (short-tailed shrew)		0.3 (1) ^a				0.6 (2)	1.4 (5)
<u>Cryptotis parva</u> (least shrew)	0.6 (2)						
Family: Cricetidae							
<u>Peromyscus maniculatus</u> (deer mouse)	18.1 (65)	0.3 (1)	14.7 (53)	8.1 (29)	4.4 (16)	0.6 (2)	
<u>Peromyscus leucopus</u> (white-footed mouse)	1.1 (4)	5.8 (21)				2.2 (8)	13.3 (48)
<u>Microtus ochrogaster</u> (prairie vole)		0.8 (3)	0.8 (3)		0.3 (1)		
<u>Pitymys pinetorum</u> (pine vole)		0.3 (1)					0.3 (1)
Family: Muridae							
<u>Mus musculus</u> (house mouse)	6.9 (25)		2.2 (8)	1.7 (6)	0.3 (1)		

Table 1. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Zapodidae							
<u>Zapus hudsonius</u>		0.3	0.6				1.1
(meadow jumping mouse)		(1)	(2)				(4)
Percent of total (313) captures	30.7 (96)	9.0 (28)	21.1 (66)	11.2 (35)	5.8 (18)	3.8 (12)	18.5 (58)

^aNumbers in parentheses represent the number of mammals captured.



Table 2. Relative abundance of small mammals captured during 2-8 August 1976 on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois. Trapping results are expressed as captures per 100 trap-nights.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Soricidae							
<u>Blarina brevicauda</u> (short-tailed shrew)		0.3 (1) ^a				0.3 (1)	1.1 (4)
<u>Cryptotis parva</u> (least shrew)	0.6 (2)						
Family: Cricetidae							
<u>Peromyscus maniculatus</u> (deer mouse)	2.8 (10)		3.9 (14)	7.8 (28)	3.1 (11)		
<u>Peromyscus leucopus</u> (white-footed mouse)		2.8 (10)				3.3 (12)	6.4 (23)
<u>Pitymys pinetorum</u> (pine vole)		0.3 (1)					
Family: Muridae							
<u>Mus musculus</u> (house mouse)	1.1 (4)	1.1 (4)	0.6 (2)	4.7 (17)			
Family: Zapodidae							
<u>Zapus hudsonius</u> (meadow jumping mouse)		0.8 (3)					
Percent of total (147) captures	10.9 (16)	12.9 (19)	10.9 (16)	30.6 (45)	7.5 (11)	8.8 (13)	18.4 (27)

^aNumbers in parentheses represent the number of mammals captured.

Table 3. Occurrence of mammals other than those captured on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 27 April-21 June 1976.

Species	Habitat ^a
Family: Didelphidae	
<u>Didelphis marsupialis</u> (opossum)	roadway; field types 1,5; woodland C
Family: Talpidae	
<u>Scalopus aquaticus</u> (eastern mole)	roadway, agricultural land
Family: Vespertilionidae	
<u>Pipistrellus subflavus</u> (eastern pipistrel)	aerial, building ^b
<u>Eptesicus fuscus</u> (big brown bat)	aerial over woodland B
<u>Lasiurus borealis</u> (red bat)	aerial over woodland B
unidentified bats	aerial
Family: Procyonidae	
<u>Procyon lotor</u> (raccoon)	aquatic; field types 1, 2, 5; woodlands A, B
Family: Mustelidae	
<u>Mephitis mephitis</u> (striped skunk)	field types 2, 5
<u>Mustela vison</u> (mink)	field type 1
<u>Mustela frenata</u> (long-tailed weasel)	aquatic near field type 1
Family: Canidae	
<u>Canis familiaris</u> (domestic dog)	field types 1, 5
Family: Felidae	
<u>Felis domestica</u> (house cat)	field type 2
Family: Castoridae	
<u>Castor canadensis</u> (beaver)	aquatic near woodland B

Table 3. Continued.

Species	Habitat ^a
Family: Sciuridae	
<u>Marmota monax</u> (woodchuck)	roadway, field type 4, woodland A
<u>Sciurus carolinensis</u> (eastern gray squirrel)	woodland B
<u>Sciurus niger</u> (eastern fox squirrel)	woodlands A, B, C
Family: Cricetidae	
<u>Ondatra zibethicus</u> (muskrat)	aquatic
Family: Muridae	
<u>Rattus norvegicus</u> (Norway rat)	roadway
Family: Leporidae	
<u>Sylvilagus floridanus</u> (eastern cottontail)	roadway; field types 1, 2, 4, 5; woodland B
Family: Cervidae	
<u>Odocoileus virginianus</u> (white-tailed deer)	field types 1, 2, 5; woodlands A, B

^aWoodlands and field types were determined from cover map, Fig. 1.

^bThree specimens were captured, identified and released.

Table 4. Occurrence of mammals other than those captured on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 2-20 August 1976.

Species	Habitat ^a
Family: Didelphidae	
<u>Didelphis marsupialis</u> (opossum)	roadway; field types 2, 3, 4, 5; woodlands A, C
Family: Talpidae	
<u>Scalopus aquaticus</u> (eastern mole)	woodland C
Family: Soricidae	
<u>Blarina brevicauda</u> (short-tailed shrew)	field type 2
Family: Vespertilionidae	
<u>Pipistrellus subflavus</u> (eastern pipistrel)	aerial
<u>Eptesicus fuscus</u> (big brown bat)	aerial
<u>Lasiurus borealis</u> (red bat)	aerial
unidentified bats	aerial
Family: Procyonidae	
<u>Procyon lotor</u> (raccoon)	field types 4, 5; woodlands A, B, C
Family: Mustelidae	
<u>Mephitis mephitis</u> (striped skunk)	roadway
Family: Canidae	
<u>Canis familiaris</u> (domestic dog)	roadway; field types 1, 2, 3; woodland B
<u>Canis latrans</u> (coyote)	roadway; field types 2, 3
<u>Vulpes fulva</u> (red fox)	field type 2
<u>Urocyon cinereoargenteus</u> (gray fox)	roadway

Table 4. Continued.

Species	Habitat ^a
Family: Castoridae	
<u>Castor canadensis</u> (beaver)	oxbow near woodland A
Family: Sciuridae	
<u>Marmota monax</u> (woodchuck)	field types 4, 5; woodlands A, C
<u>Sciurus</u> spp. (squirrels)	woodland C
Family: Cricetidae	
<u>Ondatra zibethicus</u> (muskrat)	aquatic
Family: Leporidae	
<u>Sylvilagus floridanus</u> (eastern cottontail)	roadway; field types 1, 2, 3, 4, 5; woodland A
Family: Cervidae	
<u>Odocoileus virginianus</u> (white-tailed deer)	field types 1, 5; woodlands A, B, C

^aWoodlands and field types were determined from cover map, Fig. 1.



RESULTS AND DISCUSSION

Trapping and Census Results

Mammals

Evidence of 30 species representing 15 families was noted on the study area; 8 species in 4 families were captured in snap or can traps (Tables 1, 2). Five species of small mammals were observed during field work or sign surveys (Tables 3, 4). Thirty-four percent (157 specimens) of all small mammals were captured in woodland habitats; 66 percent (303 specimens) were captured in fields. Relative abundance and trapping success of small mammals declined from spring to summer. They were less susceptible to trapping possibly due to: (1) daily temperatures above 90°F and subsequent decreased activity of small mammals and (2) increased availability of natural foods, resulting in less attraction to bait.

Small Mammals:

Scalopus aquaticus (Linnaeus), eastern mole

Ridges of broken surface soil, 5-8 inches wide indicated digging activities of eastern moles and were recorded from woodland C and agricultural land in spring and summer and a roadway on the study area in spring. No evidence of these moles was noted on mined lands although they have been reported from strip-mined lands in moist sites between spoil piles, on open and forested mine sites, and at mine edges near forests (Verts 1959, Wetzel 1958, Yeager 1942). Layne (1958) frequently found evidence of them in cultivated or fallow fields, lawns, and open woodlands.

Blarina brevicauda (Say), short-tailed shrew

Short-tailed shrews were captured in all woodlands during both trapping periods. Absence of woodlands in reclaimed areas limited their distribution to unmined land on the study area. Two dead short-tailed shrews were found in field type 2 and may have been dropped by a predator. Hoffmeister and Mohr (1972) reported that uneaten carcasses of shrews were found frequently and suggested that predators killed them but found them unpalatable. They were the most abundant mammal in many wooded areas of Illinois and lived in surface and subsurface runways. Bookhout et al. (1968) found short-tailed shrews the second most common mammal on some Ohio strip-mined land. They have been reported from strip-mined land in Illinois in wooded habitats that allowed burrowing (Verts 1959, Wetzel 1958, Yeager 1942).

Cryptotis parva (Say), least shrew

Least shrews were found only in field type 2, the reclaimed alfalfa field. Hamilton (1944) and Hoffmeister and Mohr (1972) reported that they were common in grassy, brushy, and weedy fields where they may have occupied runways of Peromyscus, Microtus, and Oryzomys. While distributed state-wide, they were rare in the northern quarter. Their presence on strip-mined land in Illinois was confirmed by Verts (1959) and Wetzel (1958).

Peromyscus maniculatus (Wagner), deer mouse

Deer mice were the most abundant small mammals captured during spring and summer, and were found on all transects except woodland A. They were captured with greatest frequency in field types 1, 2, 4, and 5 (Tables 1, 2).

Hoffmeister and Mohr (1972) stated that deer mice were abundant locally with colonies throughout the state and were found usually in prairies and areas of ungrazed and uncut grasses and forbs. The broad ecological tolerance of these mice enable them to occupy a remarkable variety of habitats throughout most of North America (Hall and Kelson 1959, Kirkland 1976).

Wetzel (1958) reported that deer mice were among the earliest invaders (within 4-6 years) in strip-mined lands in Vermillion County. Sly (1976) and Verts (1959) also found them abundant in recently mined areas. Kirkland (1976) reported their success on Pennsylvania mine wastes was enhanced by the absence or scarcity of potentially competitive species, especially white-footed mice, P. leucopus.

In spring, deer mice were captured with white-footed mice on three transects; however, in summer, deer mice and white-footed mice were never captured on the same transect. In Indiana, Sly (1976) found both in intermediate aged strip-mined areas and white-footed mice exclusively in older areas that provided woody cover. Verts (1957, 1959) reported similar results on older strip-mined land in Perry County.

Peromyscus leucopus (Rafinesque), white-footed mouse

White-footed mice were the most abundant small mammal in all forest habitats in both seasons and were found also in the alfalfa field (transect I, field type 2) in spring. The high relative abundance of these mice in woodland habitats was consistent with the report that white-footed mice were the most ubiquitous mammal in southern Illinois (Layne 1958). The habitat preference recorded for white-footed mice was forests, river bottoms, forest edges and brushy areas, possibly ranging into more open areas (Hamilton 1943, Hoffmeister and Mohr 1972).

Microtus ochrogaster (Wagner), prairie vole

Prairie voles were captured in field types 4 and 5 and woodland B in spring; none was captured in summer. Field type 4 and woodland B appeared quite dry, while field type 5 was along the Kaskaskia River. Layne (1958) reported that prairie voles were most abundant in well drained, open lands and less frequent in moist areas in southern Illinois. Lewin (1968) found them in association with dry habitats in central Illinois. Hoffmeister and Mohr (1972) reported that prairie voles were common in central and southern Illinois along fencerows, open grasslands, and meadows. Yeager (1942) suggested that they might be locally abundant in strip-mined areas, and Wetzel (1958) found them 13 years after strip-mining had ceased in Vermillion County. Verts (1959) reported them from recent and older strip-mined lands in Perry County in association with large areas of cheat (Bromus sp.) and bluegrass (Poa sp.).

Pitymys pinetorum (LeConte), pine vole

Pine voles were captured along a grassy forest edge in woodland B in both seasons and among dense herbaceous vegetation in woodland A in spring. Hoffmeister and Mohr (1972) and Layne (1958) reported that these voles required dense grassy vegetation and used underground burrows for feeding and nesting in woods, grassy fields, and orchards. Their Illinois distribution was state-wide, but sporadic in occurrence and usually uncommon.

Rattus norvegicus (Berkenhout), Norway rat

A Norway rat seen in a road that bordered agricultural land probably dispersed there from a nearby dump or the town of New Athens. Garbage

dumped along some roads on and near the edge of the study area may have provided food for these rodents. Hoffmeister and Mohr (1972) reported that Norway rats were abundant throughout Illinois and were found in urban areas, garbage dumps, ditchbanks, cornfields, feed lots, and barns. They were preyed upon in the wild by foxes, weasels, minks, owls, hawks, snakes, and other animals.

Mus musculus Linnaeus, house mouse

House mice were captured in all field types in spring; however, in summer they were captured in field types 1, 2, and 5 and woodland B. Hoffmeister and Mohr (1972) reported that house mice, abundant in Illinois, were found in buildings as well as in runways of native mice and voles. They dominated native mice and were able to drive them out of an area. Another report revealed that Mus musculus and Peromyscus polionotus were unable to coexist when restricted to a one-acre enclosure and the house mouse population declined to extinction (Caldwell and Gentry 1965). Our results indicated that neither house mice nor Peromyscus populations declined drastically on most transects during spring and summer; however, in field type 1, an increase in house mouse numbers and a decline in deer mouse numbers occurred. The house mouse to deer mouse ratio was 1:4.8 and 1:1.7 in spring and summer, respectively. Interspecific competition may have caused this change, although Caldwell and Gentry (1965) reported house mice avoided interspecific competition with P. polionotus by migratory behavior.

Capture of juveniles and reproductively active males indicated house mice reproduced on the area. Wetzel (1958) reported that house mice

probably invaded most areas of strip-mined land, but rarely established permanent populations. Verts (1959) found all house mice within 25 yards of a pond and indicated that water may influence their distribution on Perry County strip-mined land. Our results did not support his conclusion as house mice were taken away from water, especially in woodland B.

Zapus hudsonius (Zimmermann), meadow jumping mouse

Meadow jumping mice were captured in riparian and forest edge habitats in field type 5 and woodland A in spring, and woodland B in spring and summer. They were not reported previously from the study area and possibly were overlooked during trapping efforts since they normally hibernate from November to April (Hoffmeister and Mohr 1972). These were the first meadow jumping mice reported from St. Clair County (Klimstra and Roseberry 1969, Stains 1963) and only a single specimen has been collected previously from a strip-mined area in Illinois (Wetzel 1947). Hoffmeister and Mohr (1972) reported that meadow jumping mice were not abundant and inhabited moist areas on grassy or vine-covered banks of streams or ponds.

Bats

In spring, seven eastern pipistrel bats were found in the abandoned building along the oxbow of the Kaskaskia River near woodland B. Three females were captured in a mist net within the building and were later released (Table 3). Hoffmeister and Mohr (1972) reported that pipistrels, as well as species of Myotis and Eptesicus, use such buildings as maternity colonies in May and June. No bats were seen in the building

in August. Increased human disturbance and clearing of trees in woodland B probably caused this roosting site to be abandoned.

Numerous bats were seen in flight at dusk during both trapping periods (Tables 3, 4). Two species were tentatively identified on the basis of habitat, behavior, and flight. A number of bats identified as Lariurus borealis (red bat) were seen on four evenings before dusk in woodland B and in field type 2. These bats emerged from the woods and flew erratically while foraging at tree-top level along newly created openings and over the pond. Barbour and Davis (1969) reported this behavior characteristic of red bats which foraged regularly over woods, and roosted during daylight hours in foliage of trees.

Other bats identified as Eptesicus fuscus (big brown bat) were seen at dusk in clearings of woodland B and over a road east of the active mining site in spring. These bats emerged at dusk and flew a steady, nearly straight course, 20-30 feet above the ground. The large size and steady flight identified the species (Barbour and Davis 1969). Several other unidentified bats were seen in flight at dusk and dawn over a pond near the active mining site and near the mine office. Several unsuccessful attempts were made to capture bats with mist nets, slingshots, and by checking abandoned buildings. The large, open areas and numerous ponds did not concentrate bat activity nor force them to fly low enough to be captured in mist nets. Since two endangered species may have occurred on the area, shooting was not feasible.

Large Mammals

Seventeen species of large mammals representing nine families were observed or recorded during field work or sign surveys on the study area. Evidence of opossums, raccoons, domestic dogs, woodchucks, cottontails, and white-tailed deer was abundant in field and woodland habitats; these represented the common stripland species. Presence of striped skunks, minks, long-tailed weasels, coyotes, gray and red foxes, house cats, beavers, squirrels, and muskrats was noted also (Tables 3, 4).

Didelphis marsupialis Linnaeus, opossum

Tracks of opossums were numerous and recorded during both seasons in all field types, as well as in all woodlands on the study area. Hoffmeister and Mohr (1972) reported this animal an abundant woodland species throughout the state, common in a variety of habitats and of little economic value. Verts (1959) and Yeager (1942) found opossums distributed uniformly on some strip-mined land ranging even into bare areas where they dened in the ground if tree cavities or other cover was unavailable. Several opossums were expected on the Coalcon study area as food (fruits, insects, small birds, eggs, frogs, snakes, mice, carrion, etc.) was abundant.

Procyon lotor Linnaeus, raccoon

Raccoon tracks were abundant in most portions of the study area and one was seen foraging near a settling pond in woodland B in summer. Numerous woodchuck dens and widely interspersed woodlands provided suitable habitat for raccoons. Hoffmeister and Mohr (1972) and Layne (1958) reported them very common in wooded areas of Illinois, particularly bottomland forests. They have been found in many habitats including marshes

and strip-mined land. Watercourses without tree cover provided less desirable habitat, as raccoons usually denned in tree cavities. Verts (1959) found them common and uniformly distributed on strip-mined land in Perry County. Yeager (1942) reported that they seldom denned on strip-mined land unless trees were available to furnish natural cavities.

Mustela frenata Lichtenstein, long-tailed weasel

Tracks of long-tailed weasels were found near a pond east of transect IV. Hoffmeister and Mohr (1972) stated long-tailed weasels occurred throughout Illinois in brushy areas and shrubby fencerows, usually where small mammals were abundant. Field type 1 did not have the dense vegetative cover required by weasels; however, it provided woodchuck burrows for denning and abundant small mammals. Yeager (1942) reported that long-tailed weasels could possibly inhabit strip-mined land and Verts (1959) found their tracks near a pond surrounded by a heavy growth of sandbar willow (Salix interior).

Mustela vison Schreber, mink

Mink tracks were observed near a pond in field type 1 in spring (Table 3). Hoffmeister and Mohr (1972) reported that mink usually fed on muskrats or aquatic invertebrates and moved to meadows in search of Microtus, Peromyscus, or cottontails. Layne (1958), Verts (1959), and Yeager (1942) found mink near large ponds on strip-mined land in Illinois where Microtus and muskrats were abundant. Mink on strip-mined land utilized the abundant food species while occupying muskrat or woodchuck burrows.

Mephitis mephitis (Schreber), striped skunk

Tracks of striped skunks were noted in field types 2 and 5 in spring (Table 3); one was seen crossing the levee north of field type 2 in summer (Table 4); and, another was sighted in winter (Woodward-Clyde Consultants 1976a). This indicated use of the study area by skunks in all seasons although Verts (1959) thought strip-mined land was not suitable habitat for year round occupancy. Yeager (1942) found increasing populations of skunks that denned in woodchuck burrows and fed mainly on insects on strip-mined land in central Illinois. Hoffmeister and Mohr (1972) reported that striped skunks were moderately common in all counties of Illinois and were found near water in a variety of habitats: wood margins, brushy areas, fencerows, and grassy meadows. They were opportunistic feeders and denned in abandoned woodchuck or ground squirrel holes.

Vulpes fulva (Desmarest), red fox

A red fox was seen in summer in the reclaimed alfalfa field (transect I, field type 2). Layne (1958) reported the red fox was more commonly found in bottomlands in southern Illinois; Hoffmeister and Mohr (1972) reported them from rolling hills with interspersed fields, meadows, and semi-open woodlands. They denned in modified burrows of woodchucks or badgers and fed mainly on rabbits and mice. Verts (1959) rarely saw red foxes on Perry County strip-mined land, but Yeager (1942) found them in older mine sites in Vermillion County and suggested that such strip-mined areas provided the best habitat for red foxes in black-belt agricultural areas as long as rabbits, fruits, and insects were numerous and adequate cover and denning grounds were available.

Urocyon cinereoargenteus (Schreber), gray fox

In summer, a gray fox was seen in the road adjacent to field type 2 and tracks were found in a road during this period. Woodlands and reclaimed fields provided cover and food on the study area. Verts (1959) and Yeager (1942) reported gray foxes were present in all strip-mined areas, but were more abundant in later successional stages. In these areas they denned in tree cavities or among rocks. Hoffmeister and Mohr (1972) reported that the diet of gray fox was more varied than that of red fox and included many fruits, insects, and small mammals.

Canis latrans Say, coyote

Coyotes were heard howling on three occasions, and tracks were found in field types 2, 3 and in the north-south levee road (Table 4). Mine personnel and Weston researchers reported seeing animals that were probably coyotes. Open strip-mined land provided suitable habitat because banks and hillsides furnished denning sites and rabbits, rodents, insects, and birds were abundant as food. Hoffmeister and Mohr (1972) reported that the coyote occurred in much of Illinois, but was not common anywhere in the state. Coyotes have adapted to the land-clearing activities of man and several coyote-dog hybrids have been taken in Illinois. Anderson (1951) reported 65 coyotes taken in Fulton County in a 5-year period. Klimstra and Roseberry (1969) reported them from Perry, Williamson, Marion, Jackson, and Johnson counties. Layne (1958) and Verts (1959) also found them on strip-mined land in Perry County.

Canis familiaris, domestic dog
Felis domestica, house cat

Tracks of domestic dogs and cats were found in roads, fields, and woodlands on the study area. A house cat was seen eating a Norway rat along a haul road in spring. Rodents, rabbits, and birds were numerous on the study area and probably provided abundant food for these animals. Yeager (1942) found that feral or free-ranging dogs and cats were numerous on practically all strip mines he studied.

Marmota monax Linnaeus, woodchuck

Woodchucks were numerous on the area and burrows were found in all fields and woodlands. Two woodchucks were seen moving from reclaimed spoil banks to a soybean field adjacent to the study area, presumably for feeding. For denning, Hoffmeister and Mohr (1972) reported that they preferred rolling, well-drained land at forest edges. Bookhout et al. (1968) and Riley (1954) found woodchucks as abundant or more abundant on strip-mined land than on surrounding forests and farms. On the study area, their activity appeared greater on mined land than in adjacent woodlands and agricultural land. Because woodchucks were not collected, relative abundance on mined and unmined land was undetermined.

Collins (1958) and Verts (1959) reported that reclaimed strip-mined land, especially rocky portions of spoilbanks, provided suitable woodchuck habitat. Active dens have been observed in strip-mined areas of all ages in Perry County (Layne 1958, Verts 1959) where woodchuck activity was concentrated in rocky areas supporting a dense growth of sweet clover (Melilotus spp.). Both young and adults commonly fed on weedy plants: clover, alfalfa, dandelions, wild lettuce, and plantain; all of which were common on

the New Athens study area. Woodchucks were important on strip-mined land, as abandoned burrows provided dens for skunks, rabbits, or foxes (DeCapita and Bookhout 1975, Hoffmeister and Mohr 1972, Yeager 1940).

Sciurus carolinensis Gmelin, eastern gray squirrel
Sciurus niger Linnaeus, eastern fox squirrel

Gray and fox squirrels were seen only in woodlands in spring and several nests were found in woodland C in summer. Their distribution on the study area was probably limited by the lack of mast-producing trees. The gray squirrel was fairly common in Illinois in wooded areas with ample cover, particularly dense, mature forests (Hoffmeister and Mohr 1972). In southern Illinois, they were most common in extensively forested uplands of oak-hickory and beech-maple, and were less frequent in typical bottomland woods (Layne 1958). Verts (1959) found gray squirrels only in unmined forests near Perry County strip-mined areas, while Yeager (1942) observed them in the oldest mined areas. They were not abundant in young, flood plain forests, as mast-bearing trees were necessary for food and denning.

Eastern fox squirrels were found in open woodlands throughout Illinois where they spent much time on the ground along hedgerows and among widely scattered trees (Hoffmeister and Mohr 1972). In southern Illinois, they characteristically inhabited bottomland forests, isolated woodlots and fencerows (Layne 1958). Although these squirrels were tolerant of open areas, Yeager (1942) suggested that the lack of mast-producing trees probably limited their distribution on strip-mined lands. This lack of food may also have affected the distribution and abundance of squirrels on the study area.

Castor canadensis Kuhl, beaver

Tracks and cut willows indicated periodic use of the study area by beavers, particularly in woodland A which provided the continuous supply of water and poplar, maple, birch, and willows required by them (Hoffmeister and Mohr 1972). Verts (1959) reported that strip-mine ponds were occasionally used by beaver, but permanent colonies were limited by insufficient food. They were once abundant in Illinois, but due to excessive trapping, became rare (Hoffmeister and Mohr 1972). In restocking programs from 1929-1938, 46 animals were released in five counties. By 1954, they had spread to 55 counties and established nearly 600 colonies (Pietsch 1956). Human disturbance and construction on the study area probably limited use by beavers.

Ondatra zibethicus (Linnaeus), muskrat

Numerous bank dens of muskrats were seen in larger ponds and along the Kaskaskia River in spring and summer. Muskrats had been found typically along rivers, streams, drainage ditches, marshes, lakes, ponds, and water-filled strip-mined areas throughout Illinois, particularly in the northern portion (Hoffmeister and Mohr 1972). They were fairly common in ponds and lakes large enough to hold water year round on Perry County strip-mined land (Layne 1958, Verts 1959). Arata (1959) studied this population and reported their low average litter size was due to: food scarcity in winter, limited burrow sites, irregular terrain, and absence of running streams for dispersal. Yeager (1942), however, suggested that heavy muskrat populations might occur on strip-mine sites where they depend on bank dens in cattail areas. On these areas, cattails (Typha spp.) provided important food and housing material since they composed 50 percent of the summer diet and 75 percent in

winter (Arata 1959). Muskrats also feed on white sweet clover and wild parsnips (Pastinaca sp.), and may damage aquatic plantings in strip-mine ponds (Yeager 1942).

Sylvilagus floridanus (Allen), eastern cottontail

Adult and juvenile cottontails were numerous in all field types and woodlands A and B throughout both seasons. Hoffmeister and Mohr (1972) found them in brushy or weedy fields, fencerows, woodlot margins, forest edges, and dry bottomlands. Cottontails, common in the western half and southern third of Illinois (Lord 1963), were common also in spoil areas of strip-mined land, particularly in recently mined areas (Collins 1958, Layne 1958, Verts 1959). Ripley (1954) reported that they were more abundant on some Ohio strip-mined land than on adjacent abandoned farmland. Yeager (1942) found one rabbit per 4.6 acres on strip-mined land and one rabbit on 17.3 acres of adjacent farmland in Illinois. He suggested that numbers were maintained on recently strip-mined land due to early successional vegetation which provided food and cover.

Odocoileus virginianus (Zimmermann), white-tailed deer

Three deer were seen on the study area in woodlands, as well as one which was seen along a road. In addition, remains of one which had probably died the previous winter were found in woodland B. Tracks were abundant in field types 1, 2, and 5 and in all woodlands. Calhoun and Loomis (1974) reported that white-tailed deer were distributed throughout Illinois, but were most abundant in eastern black prairie counties. In southern Illinois, Layne (1958) observed signs most frequently in bottomlands. Verts (1959) found little evidence of them on Perry County strip-mined land; however,

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Urbanek (1976) reported that white-tailed deer were not uncommon in strip-mined areas of Williamson and Saline counties. The abundance of deer on the study area was probably due to the remaining woodlands adjacent to the reclaimed fields, because deer reportedly require wooded tracts interspersed with open areas for feeding (Hoffmeister and Mohr 1972). Yeager (1940) recognized that much reclaimed strip-mined land met these habitat requirements and provided suitable areas for restocking. Collins (1958) found that deer in western Kentucky moved from a stocked area into a reclaimed spoil area.

Birds

A total of 121 species representing 33 families of birds was recorded from the study area; of these, 109 species were seen in spring, and 81 in summer (Tables 5-8). Many summer and permanent residents presumably bred on the area; nests or fledglings of 17 species were found during spring and summer censuses (Tables 9, 10). Greater numbers of species and individuals were observed during the spring census when at least 35 migratory species used the area (Table 11).

During both census periods greater bird diversity and density was found in woodland habitats. Numbers of birds closely followed ecological succession with more species in later successional stages. Fewer birds were recorded in late summer because many species had already left the area. Other species no longer sang since they were not breeding and, therefore, were more difficult to observe.

Sixty-three species of birds were seen along the seven transects in spring (Table 5), and 41 were seen in summer (Table 6). Gray catbirds, red-winged blackbirds, common grackles, brown-headed cowbirds, cardinals, indigo buntings, American goldfinches, and field sparrows were among the most abundant species observed during bird censuses in both seasons. These were seen frequently in both field and woodland habitat types. Others observed in both habitats included rufous-sided towhees, downy woodpeckers, and ruby-throated hummingbirds. These species were more abundant during the summer census. Some species observed only in woodlands, although not abundant, were: Carolina wrens, tufted titmice, red-eyed vireos, and acadian flycatchers. Song sparrows, horned larks, and mourning doves were seen in field habitats in both seasons and probably nested on the area.

Table 5. Number of birds per acre observed or heard along seven transects on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 19 May-1 June 1976.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Phasianidae							
<u>Colinus virginianus</u> (bobwhite)					.05 (1) ^a		
Family: Charadriidae							
<u>Charadrius vociferus</u> (killdeer)	.05 (1)			.34 (7)	.10 (2)		
Family: Scolopacidae							
<u>Calidris pusillus</u> (semipalmated sandpiper)				.77 (16)			
Family: Columbidae							
<u>Zenaidura macroura</u> (mourning dove)	.05 (1)	.07 (1)		.05 (1)	.10 (2)		
Family: Cuculidae							
<u>Coccyzus americanus</u> (yellow-billed cuckoo)		.27 (4)					.07 (1)
Family: Strigidae							
<u>Strix varia</u> (barred owl)						.07 (1)	
Family: Caprimulgidae							
<u>Chordeiles minor</u> (common nighthawk)							.15 (2)

Table 5. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Trochilidae							
<u>Archilochus colubris</u> (ruby-throated hummingbird)		.20 (3)					.07 (1)
Family: Picidae							
<u>Colaptes auratus</u> (common flicker)		.07 (1)				.36 (1)	
<u>Centurus carolinus</u> (red-bellied woodpecker)		.14 (2)					.15 (2)
<u>Dendrocopos pubescens</u> (downy woodpecker)		.34 (5)	.10 (2)			.15 (2)	.29 (4)
Family: Tyrannidae							
<u>Tyrannus tyrannus</u> (eastern kingbird)		.07 (1)			.19 (4)		
<u>Myiarchus crinitus</u> (great crested flycatcher)		.07 (1)				.29 (4)	.15 (2)
<u>Empidonax virescens</u> (acadian flycatcher)		.68 (10)				.51 (7)	1.67 (23)
<u>Empidonax traillii</u> (willow flycatcher)			.05 (1)				
<u>Contopus virens</u> (eastern wood pewee)							.07 (1)
<u>Nuttallornis borealis</u> (olive-sided flycatcher)		.07 (1)					
Family: Alaudidae							
<u>Eremophila alpestris</u> (horned lark)	.48 (10)			.77 (16)			

Table 5. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Corvidae							
<u>Cyanocitta cristata</u> (blue jay)						.44 (6)	.15 (2)
<u>Corvus brachyrhynchos</u> (common crow)		.07 (1)				.15 (2)	
Family: Paridae							
<u>Parus carolinensis</u> (Carolina chickadee)		.34** (5)			.29 (6)	.58 (8)	.58 (8)
<u>Parus bicolor</u> (tufted titmouse)		.47 (7)				.36 (5)	.94 (13)
Family: Troglodytidae							
<u>Thryothorus ludovicianus</u> (Carolina wren)		.14** (2)				.29 (4)	.65 (9)
Family: Mimidae							
<u>Dumetella carolinensis</u> (gray catbird)		.20** (3)	.58 (12)		.19 (4)	.15 (2)	
<u>Toxostoma rufum</u> (brown thrasher)					.29 (6)	.07 (1)	
Family: Turdidae							
<u>Turdus migratorius</u> (American robin)		.07 (1)			.10 (2)		
<u>Hylocichla ustulata</u> (wood thrush)		.07 (1)				.07 (1)	
<u>Catharus ustulata</u> (Swainson's thrush)							.07 (1)

Table 5. Continued.

Species	Transsect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
<u>Catharus minima</u> (gray-cheeked thrush)						.07 (1)	
Family: Sylviidae							
<u>Poliioptila caerulea</u> (blue-gray gnatcatcher)		.20 (3)				.15 (2)	.07 (1)
Family: Bombycillidae							
<u>Bombycilla cedrorum</u> (cedar waxwing)			.87 (18)				
Family: Vireonidae							
<u>Vireo griseus</u> (white-eyed vireo)							.29 (4)
<u>Vireo olivaceus</u> (red-eyed vireo)		.47 (7)				.29 (4)	1.38 (19)
<u>Vireo philadelphicus</u> (Philadelphia vireo)		.07 (1)					
<u>Vireo gilvus</u> (warbling vireo)		.07 (1)					.15 (2)
Family: Parulidae							
<u>Parula americana</u> (parula warbler)							.07 (1)
<u>Dendroica petechia</u> (yellow warbler)			.05 (1)		.05 (1)		.07 (1)
<u>Dendroica magnolia</u> (magnolia warbler)		.07 (1)					
<u>Dendroica dominica</u> (yellow-throated warbler)							.07 (1)

Table 5. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
<u>Geothlypis trichas</u> (common yellowthroat)		.07* (1)	.48 (10)				
<u>Icteria virens</u> (yellow-breasted chat)		.20** (3)					.07 (1)
<u>Oporornis formosus</u> (Kentucky warbler)						.29 (4)	
<u>Oporornis agilis</u> (Connecticut warbler)		.07 (1)					
<u>Setophaga ruticilla</u> (American redstart)		.88 (13)					4.14 (57)
Family: Icteridae							
<u>Dolichonyx oryzivorus</u> (bobolink)		.15 (3)					
<u>Sturnella magna</u> (eastern meadowlark)	.19 (4)				.24 (5)		
<u>Agelaius phoeniceus</u> (red-winged blackbird)	.44 (9)	4.12 (61)	2.42 (50)	.05 (1)	.97 (20)	.22 (3)	.07 (1)
<u>Quiscalus quiscula</u> (common grackle)		4.25 (63)			.39 (8)	.73 (10)	.07 (1)
<u>Molothrus ater</u> (brown-headed cowbird)	.97 (20)	.81** (12)	.10 (2)	.15 (3)	1.16 (24)	1.09 (15)	1.16 (16)
<u>Icterus spurius</u> (orchard oriole)					.05 (1)		
<u>Icterus galbula</u> (northern oriole)		.14 (2)			.05 (1)		.07 (1)

Table 5. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: <u>Fringillidae</u>							
<u>Cardinalis cardinalis</u> (cardinal)		1.01 (15)	.05 (1)			.80 (11)	1.24 (17)
<u>Pheucticus ludovicianus</u> (rose-breasted grosbeak)			.05 (1)				
<u>Guiraca caerulea</u> (blue grosbeak)			.05 (1)				
<u>Passerina cyanea</u> (indigo bunting)	.05 (1)	1.01** (15)	1.55 (32)		.63 (13)	1.02 (14)	1.31 (18)
<u>Spinus tristis</u> (American goldfinch)		.54** (8)	.29 (6)		.87 (18)	.15 (2)	.58 (8)
<u>Spiza americana</u> (dickcissel)	.63 (13)		.58 (12)				
<u>Pipilo erythrophthalmus</u> (rufous-sided towhee)		.20** (3)				.15 (2)	
<u>Ammodramus savannarum</u> (grasshopper sparrow)	.24 (5)						
<u>Spizella pusilla</u> (field sparrow)		.27* (4)	1.36 (28)		.48 (10)	.22 (3)	
<u>Zonotrichia leucophrys</u> (white-crowned sparrow)					.05 (1)		
<u>Melospiza lincolni</u> (Lincoln's sparrow)		.07 (1)					.07 (1)
<u>Melospiza melodia</u> (song sparrow)	.53 (11)		1.50 (31)				

Table 5. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Percent of total (1,061) birds seen	7.35 (78)	24.88 (264)	19.60 (208)	4.15 (44)	12.16 (129)	11.22 (119)	20.64 (219)
Total density	3.78	17.83	10.07	2.13	6.24	8.64	15.90

^aNumbers in parentheses represent the number of birds seen or heard during the six censuses.

*Species found only along the edge of the woodland transect.

**Species found along the edge as well as in the woodland vegetation.

Table 6. Number of birds per acre observed or heard along seven transects on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 10-19 August 1976.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Phasianidae							
<u>Colinus virginianus</u> (bobwhite)	.05 (1)a				.05 (1)		
Family: Ardeidae							
<u>Butorides virescens</u> (green heron)				.19 (4)			
Family: Charadriidae							
<u>Charadrius vociferus</u> (killdeer)				.29 (6)			
Family: Scolopacidae							
<u>Calidris melanotos</u> (pectoral sandpiper)				.29 (6)			
<u>Calidris minutilla</u> (least sandpiper)				.53 (11)			
Family: Columbidae							
<u>Zenaidura macroura</u> (mourning dove)		.20 (3)			.24 (5)		
Family: Cuculidae							
<u>Coccyzus americanus</u> (yellow-billed cuckoo)		.14 (2)					
Family: Trochilidae							
<u>Archilochus colubris</u> (ruby-throated hummingbird)	.05 (1)	.07 (1)	.53 (11)			.07 (1)	.22 (3)

Table 6. Continued

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Picidae							
<u>Colaptes auratus</u> (common flicker)						.29 (4)	.07 (1)
<u>Dryocopus pileatus</u> (pileated woodpecker)		.07 (1)					
<u>Centurus carolinus</u> (red-bellied woodpecker)		.14 (2)	.36 (5)				
<u>Dendrocopos villosus</u> (hairy woodpecker)		.07 (1)					
<u>Dendrocopos pubescens</u> (downy woodpecker)		.27 (4)			.14 (3)	.29 (4)	.51 (7)
Family: Tyrannidae							
<u>Myiarchus crinitus</u> (great crested flycatcher)						.07 (1)	
<u>Empidonax virescens</u> (acadian flycatcher)		.27 (4)				.44 (6)	1.09 (15)
<u>Contopus virens</u> (eastern wood pewee)		.07 (1)				.15 (2)	
Family: Alaudidae							
<u>Eremophila alpestris</u> (horned lark)	.05 (1)			.48 (10)			
Family: Corvidae							
<u>Cyanocitta cristata</u> (blue jay)						.15 (2)	.07 (1)

Table 6. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
Family: Paridae							
<u>Parus carolinensis</u> (Carolina chickadee)		.41 (6)				.29 (4)	.29 (4)
<u>Parus bicolor</u> (tufted titmouse)		.74 (11)				.94 (13)	.36 (5)
Family: Troglodytidae							
<u>Troglodytes aedon</u> (house wren)					.19 (4)		
<u>Thryothorus ludovicianus</u> (Carolina wren)		.14 (2)				1.31 (18)	.44 (6)
Family: Mimidae							
<u>Dumetella carolinensis</u> (gray catbird)		.20** (3)	.05 (1)		.05 (1)	.15 (2)	.73 (10)
Family: Turdidae							
<u>Hylocichla ustelina</u> (wood thrush)						.15 (2)	.15 (2)
Family: Sylviidae							
<u>Polioptila caerulea</u> (blue-gray gnatcatcher)		.20 (3)					
Family: Vireonidae							
<u>Vireo griseus</u> (white-eyed vireo)		.20 (3)					.07 (1)
<u>Vireo olivaceus</u> (red-eyed vireo)							.65 (9)

Table 6. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
<u>Vireo gilvus</u> (warbling vireo)							.15 (2)
Family: Parulidae							
<u>Dendroica petechia</u> (yellow warbler)			.05 (1)				
<u>Geothlypis trichas</u> (common yellowthroat)			.15 (3)				
<u>Setophaga ruticilla</u> (American redstart)		.54 (8)				.15 (2)	3.27 (45)
Family: Icteridae							
<u>Agelaius phoeniceus</u> (red-winged blackbird)	.05 (1)		.53 (11)				
Family: Fringillidae							
<u>Cardinalis cardinalis</u> (cardinal)	1.62 (24)				.05 (1)	1.45 (20)	2.18 (30)
<u>Guiraca caerulea</u> (blue grosbeak)					.05 (1)		
<u>Passerina cyanea</u> (indigo bunting)		.47** (7)	2.57 (53)	.53 (11)	.58 (12)		.15 (2)
<u>Spinus tristis</u> (American goldfinch)	.05 (1)	.61 (9)	.63 (13)	.58 (12)	.34 (7)		.07 (1)
<u>Spiza americana</u> (dickcissel)			.10 (2)				
<u>Pipilo erythrophthalmus</u> (rufous-sided towhee)		.61** (9)	.15 (3)			.36 (5)	

Table 6. Continued.

Species	Transect						
	I (Field type 2)	II (Woodland B)	III (Field type 5)	IV (Field type 1)	V (Field type 4)	VI (Woodland C)	VII (Woodland A)
<u>Ammodramus savannarum</u> (grasshopper sparrow)	.19 (4)						
<u>Spizella pusilla</u> (field sparrow)		.20** (3)	.29 (6)		.19 (4)		
<u>Melospiza melodia</u> (song sparrow)	.24 (5)		.44 (9)	.24 (5)	.09 (2)		
Percent of total (575) birds seen	2.44 (14)	18.61 (107)	19.65 (113)	11.30 (65)	7.13 (41)	15.83 (91)	25.04 (144)
Total density	.68	7.22	5.47	3.15	1.98	6.68	10.46

^aNumbers in parentheses represent the number of birds seen or heard during the six censuses.

**Species found along the edge as well as in the woodland vegetation.

Table 7. Birds observed or heard in locations other than along seven transects on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 19 May-21 June 1976.

Species	Habitat ^a
Family: Podicipedidae	
<u>Podilymbus podiceps</u> (pied-billed grebe)	Aquatic
Family: Anatidae	
<u>Anas platyrhynchos</u> (mallard)	aquatic
<u>Aix sponsa</u> (wood duck)	aquatic
Family: Cathartidae	
<u>Cathartes aura</u> (turkey vulture)	aerial
Family: Accipitridae	
<u>Ictinia mississippiensis</u> (Mississippi kite)	aerial
<u>Buteo jamaicensis</u> (red-tailed hawk)	aerial, woodland B
Family: Phasianidae	
<u>Colinus virginianus</u> (bobwhite)	field types 2, 5; woodlands B, C
Family: Ardeidae	
<u>Ardea herodias</u> (great blue heron)	aerial
<u>Florida caerulea</u> (little blue heron)	aerial
<u>Butorides virescens</u> (green heron)	aquatic, roadway, field type 1
Family: Charadriidae	
<u>Charadrius vociferus</u> (killdeer)	roadway, field type 5, oxbow of Kaskaskia River
Family: Scolopacidae	
<u>Actitis macularia</u> (spotted sandpiper)	aquatic
<u>Tringa flavipes</u> (lesser yellowlegs)	aerial

Table 7. Continued.

Species	Habitat ^a
Family: Columbidae	
<u>Zenaida macroura</u> (mourning dove)	field type 5; woodlands A, C
Family: Cuculidae	
<u>Coccyzus americanus</u> (yellow-billed cuckoo)	woodland C
<u>Coccyzus erythrophthalmus</u> (black-billed cuckoo)	woodlands B, C
Family: Strigidae	
<u>Bubo virginianus</u> (great horned owl)	woodland A
<u>Strix varia</u> (barred owl)	woodland B
Family: Caprimulgidae	
<u>Chordeiles minor</u> (common nighthawk)	aerial
Family: Apodidae	
<u>Chaetura pelagica</u> (chimney swift)	aerial
Family: Alcedinidae	
<u>Megaceryle alcyon</u> (belted kingfisher)	aerial, oxbow of Kaskaskia River
Family: Picidae	
<u>Colaptes auratus</u> (common flicker)	field type 4, woodland A
<u>Dryocopus pileatus</u> (pileated woodpecker)	woodlands A, B
<u>Centurus carolinus</u> (red-bellied woodpecker)	woodland C
<u>Melanerpes erythrocephalus</u> (red-headed woodpecker)	woodlands A, B, C
<u>Dendrocopos villosus</u> (hairy woodpecker)	woodland B
<u>Dendrocopos pubescens</u> (downy woodpecker)	field type 4
Family: Tyrannidae	
<u>Tyrannus tyrannus</u> (eastern kingbird)	field types 2, 5; woodland C

Table 7. Continued.

Species	Habitat ^a
<u>Myiarchus crinitus</u> (great crested flycatcher)	field type 4
<u>Sayornis phoebe</u> (eastern phoebe)	woodlands B, C
<u>Empidonax traillii</u> (willow flycatcher)	field type 4
<u>Empidonax alnorum</u> (alder flycatcher)	woodland B
<u>Empidonax minimus</u> (least flycatcher)	woodland C
<u>Contopus virens</u> (eastern wood pewee)	woodlands B, C
Family: Alaudidae	
<u>Eremophila alpestris</u> (horned lark)	field types 4, 5
Family: Hirundinidae	
<u>Hirundo rustica</u> (barn swallow)	aerial
<u>Riparia riparia</u> (bank swallow)	aerial
<u>Stelgidopteryx ruficollis</u> (rough-winged swallow)	aerial
<u>Progne subis</u> (purple martin)	aerial
Family: Corvidae	
<u>Cyanocitta cristata</u> (blue jay)	field types 4, 5; woodland B
<u>Corvus brachyrhynchos</u> (common crow)	aerial over field type 5
Family: Sittidae	
<u>Sitta carolinensis</u> (white-breasted nuthatch)	woodland B
Family: Troglodytidae	
<u>Troglodytes aedon</u> (house wren)	woodland B
Family: Mimidae	
<u>Dumetella carolinensis</u> (gray catbird)	field type 4, woodland A
<u>Toxostoma rufum</u> (brown thrasher)	field types 4, 5

Table 7. Continued.

Species	Habitat ^a
Family: Turdidae	
<u>Turdus migratorius</u> (American robin)	woodland C
<u>Hylocichla mustelina</u> (wood thrush)	woodland A
<u>Catharus ustulata</u> (Swainson's thrush)	woodland B
<u>Catharus minima</u> (gray-cheeked thrush)	woodland A
<u>Sialia sialis</u> (eastern bluebird)	woodland B
Family: Bombycillidae	
<u>Bombycilla cedrorum</u> (cedar waxwing)	field type 4; woodlands A, C
Family: Sturnidae	
<u>Sturnus vulgaris</u> (starling)	field types 1, 4; woodlands B, C
Family: Vireonidae	
<u>Vireo griseus</u> (white-eyed vireo)	woodlands B, C
<u>Vireo bellii</u> (Bell's vireo)	field types 4, 5
<u>Vireo flavifrons</u> (yellow-throated vireo)	woodlands A, B, C
<u>Vireo gilvus</u> (warbling vireo)	field types 4, 5
Family: Parulidae	
<u>Mniotilta varia</u> (black and white warbler)	woodland B
<u>Protonotaria citrea</u> (prothonotary warbler)	woodland A
<u>Vermivora peregrina</u> (Tennessee warbler)	field types 2, 4, 5; woodlands B, C
<u>Vermivora ruficapilla</u> (Nashville warbler)	field type 5, woodland B
<u>Parula americana</u> (parula warbler)	woodland B
<u>Dendroica petechia</u> (yellow warbler)	woodland B
<u>Dendroica fusca</u> (blackburnian warbler)	woodland C

Table 7. Continued.

Species	Habitat ^a
<u>Dendroica castanea</u> (bay-breasted warbler)	woodlands B, C
<u>Dendroica striata</u> (blackpoll warbler)	woodlands A, B, C
<u>Seiurus aurocapillus</u> (ovenbird)	woodland C
<u>Geothlypis trichas</u> (common yellowthroat)	field type 4, woodland A
<u>Icteria virens</u> (yellow-breasted chat)	woodland C
<u>Oporornis formosus</u> (Kentucky warbler)	woodlands A, B
<u>Oporornis philadelphia</u> (mourning warbler)	woodland B
<u>Wilsonia canadensis</u> (Canada warbler)	woodland A
<u>Setophaga ruticilla</u> (American redstart)	field type 4
Family: Icteridae	
<u>Dolichonyx oryzivorus</u> (bobolink)	field type 5
<u>Agelaius phoeniceus</u> (red-winged blackbird)	aquatic
Family: Thraupidae	
<u>Piranga olivacea</u> (scarlet tanager)	woodlands B, C
<u>Piranga rubra</u> (summer tanager)	woodland C
Family: Fringillidae	
<u>Cardinalis cardinalis</u> (cardinal)	roadway, field type 4
<u>Pheucticus ludovicianus</u> (rose-breasted grosbeak)	woodland C
<u>Guiraca caerulea</u> (blue grc sbeak)	field type 4
<u>Passerina cyanea</u> (indigo bunting)	roadway
<u>Spinus tristis</u> (American goldfinch)	roadway
<u>Spiza americana</u> (dickcissel)	field types 1, 4

Table 7. Continued.

Species	Habitat ^a
<u>Pipilo erythrophthalmus</u> (rufous-sided towhee)	woodland A
<u>Passerculus sandwichensis</u> (savannah sparrow)	field type 2
<u>Chondestes grammacus</u> (lark sparrow)	field type 5
<u>Spizella pusilla</u> (field sparrow)	field type 2
<u>Melospiza melodia</u> (song sparrow)	field type 4; woodlands A, B

^aWoodlands and field types were determined from cover map, Fig. 1.

Table 8. Birds observed or heard in locations other than along seven transects on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 2-20 August, 1976.

Species	Habitat ^a
Family: Anatidae	
<u>Anas platyrhynchos</u> (mallard)	aerial over Kaskaskia River, oxbow; pond in field type 1
<u>Anas discors</u> (blue-winged teal)	aerial over oxbow; pond in field type 1
<u>Anas crecca</u> (green-winged teal)	pond in field type 1
<u>Aix sponsa</u> (wood duck)	aerial over Kaskaskia River; ponds in field types 1, 4
Family: Accipitridae	
<u>Buteo jamaicensis</u> (red-tailed hawk)	aerial over field types 1, 4, 5; woodland C
<u>Falco sparverius</u> (American kestrel)	aerial over field types 1, 2
Family: Phasianidae	
<u>Colinus virginianus</u> (bobwhite)	field types 1, 2, 3
Family: Ardeidae	
<u>Casmerodius albus</u> (great egret)	aerial over Kaskaskia River
<u>Ardea herodias</u> (great blue heron)	Kaskaskia River, oxbow; pond in field types 1, 4
<u>Florida caerulea</u> (little blue heron)	Kaskaskia River, oxbow, pond in field type 1
<u>Butorides virescens</u> (green heron)	Kaskaskia River, oxbow, ponds in field type 4, woodland B
Family: Charadriidae	
<u>Charadrius semipalmatus</u> (semipalmated plover)	pond in field type 1
<u>Charadrius vociferus</u> (killdeer)	aerial over field type 5, woodland B; field types 1, 4
Family: Scolopacidae	
<u>Actinias macularia</u> (spotted sandpiper)	oxbow, pond in field type 1
<u>Tringa solitaria</u> (solitary sandpiper)	aerial over field type 4, pond in field type 1
<u>Tringa melanoleucus</u> (greater yellowlegs)	pond in field type 1
<u>Tringa flavipes</u> (lesser yellowlegs)	pond in field type 1

Table 8. Continued

Species	Habitat ^a
<u>Micropalma himantopus</u> (stilt sandpiper)	pond in field type 1
<u>Limnodromus griseus</u> (short-billed dowitcher)	pond in field type 1
<u>Calidris bairdii</u> (Baird's sandpiper)	pond in field type 1
<u>Calidris minutilla</u> (least sandpiper)	field type 4
Family: Columbidae	
<u>Zenaida macoura</u> (mourning dove)	aerial over field types 1, 4, 5, 6; woodland A
Family: Cuculidae	
<u>Coccyzus americanus</u> (yellow-billed cuckoo)	field type 3; woodlands A, C
Family: Strigidae	
<u>Bubo virginianus</u> (great horned owl)	woodland A
<u>Strix varia</u> (barred owl)	woodland A
Family: Caprimulgidae	
<u>Chordeiles minor</u> (common nighthawk)	aerial over field type 5
Family: Apodidae	
<u>Chaetura pelagica</u> (chimney swift)	aerial over field types 1, 2, 5; woodlands A, B, C
Family: Trochilidae	
<u>Archilochus colubris</u> (ruby-throated hummingbird)	aerial, field type 6
Family: Alcedinidae	
<u>Megaceryle alcyon</u> (belted kingfisher)	aerial over field type 1, oxbow
Family: Picidae	
<u>Colaptes auratus</u> (common flicker)	field types 2, 4, 5, 6; woodland B
<u>Dryocopus pileatus</u> (pileated woodpecker)	aerial over field type 5, woodlands A, C

Table 8. Continued.

Species	Habitat ^a
<u>Centurus carolinus</u> (red-bellied woodpecker)	field type 2, woodland A
<u>Melanerpes erythrocephalus</u> (red-headed woodpecker)	woodlands B, C
<u>Dendrocopos pubescens</u> (downy woodpecker)	field type 3
Family: Tyrannidae	
<u>Tyrannus tyrannus</u> (eastern kingbird)	aerial over field types 2, 5; field type 4
<u>Myiarchus crinitus</u> (great crested flycatcher)	woodlands B, C
Family: Alaudidae	
<u>Eremophila alpestris</u> (horned lark)	field types 4, 5
Family: Hirundinidae	
<u>Hirundo rustica</u> (barn swallow)	aerial over field types 1, 2, 5; woodland A
<u>Riparia riparia</u> (bank swallow)	aerial over field type 1, 2, 4, 5; woodlands B, C
<u>Stelgidopteryx ruficollis</u> (rough-winged swallow)	aerial over field types 1, 5
<u>Progne subis</u> (purple martin)	aerial over field types 1, 5
Family: Corvidae	
<u>Cyanocitta cristata</u> (blue jay)	roadway
<u>Corvus brachyrhynchos</u> (common crow)	aerial over woodlands B, C; field types 2, 3
Family: Paridae	
<u>Parus carolinensis</u> (Carolina chickadee)	field type 4
<u>Parus bicolor</u> (tufted titmouse)	field type 4
Family: Troglodytidae	
<u>Troglodytes aedon</u> (house wren)	woodland C
<u>Thryothorus ludovicianus</u> (Carolina wren)	field type 6

Table 8. Continued.

Species	Habitat ^a
Family: Mimidae	
<u>Mimus polyglottos</u> (mockingbird)	aerial, field type 5
<u>Dumetella carolinensis</u> (gray catbird)	roadway, field type 6
<u>Toxostoma rufum</u> (brown thrasher)	field type 2, woodland C
Family: Turdidae	
<u>Hylocichla mustelina</u> (wood thrush)	woodland C
<u>Sialia sialis</u> (eastern bluebird)	woodlands A, B
Family: Sylviidae	
<u>Polioptila caerulea</u> (blue-gray gnatcatcher)	field type 4; woodlands A, C
Family: Sturnidae	
<u>Sturnus vulgaris</u> (starling)	aerial; field types 1, 5
Family: Vireonidae	
<u>Vireo griseus</u> (white-eyed vireo)	field type 6
<u>Vireo bellii</u> (Bell's vireo)	field type 5
<u>Vireo flavifrons</u> (yellow-throated vireo)	woodland C
<u>Vireo olivaceus</u> (red-eyed vireo)	field type 6; woodland B, C
Family: Parulidae	
<u>Parula americana</u> (parula warbler)	woodland A
<u>Geothlypis trichas</u> (common yellowthroat)	field type 6
<u>Icteria virens</u> (yellow-breasted chat)	field type 6
<u>Setophaga ruticilla</u> (American redstart)	field type 6
Family: Icteridae	
<u>Sturnella magna</u> (eastern meadowlark)	field type 2

Table 8. Continued.

Species	Habitat ^a
<u>Agelaius phoeniceus</u> (red-winged blackbird)	aerial over woodland B
<u>Quiscalus quiscula</u> (common grackle)	aerial over woodland B
<u>Molothrus ater</u> (brown-headed cowbird)	field type 6
Family: Fringillidae	
<u>Cardinalis cardinalis</u> (cardinal)	field types 2, 6
<u>Guiraca caerulea</u> (blue grosbeak)	field type 3
<u>Passerina cyanea</u> (indigo bunting)	roadway, field type 3, woodland C
<u>Spinus tristis</u> (American goldfinch)	field types 2, 3, 5, 6; woodland C
<u>Pipilo erythrophthalmus</u> (rufous-sided towhee)	field types 2, 6
<u>Spizella pusilla</u> (field sparrow)	field types 2, 3

^aWoodlands and field types were determined from cover map, Fig. 1.

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Table 9. Species found breeding (nests or fledglings) on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, 19 May-21 June 1976.

Species
<u>Anas platyrhynchos</u> (mallard)
<u>Aix sponsa</u> (wood duck)
<u>Charadrius vociferus</u> (killdeer)
<u>Megaceryle alcyon</u> (belted kingfisher)
<u>Dendrocopos pubescens</u> (downy woodpecker)
<u>Empidonax virescens</u> (acadian flycatcher)
<u>Eremophila alpestris</u> (horned lark)
<u>Riparia riparia</u> (bank swallow)
<u>Stelgidopteryx ruficollis</u> (rough-winged swallow)
<u>Thryothorus ludovicianus</u> (Carolina wren)
<u>Dumetella carolinensis</u> (gray catbird)
<u>Toxostoma rufum</u> (brown thrasher)
<u>Vireo olivaceus</u> (red-eyed vireo)
<u>Spizella pusilla</u> (field sparrow)

COGNITION

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Table 10. Species found breeding (nests or fledglings) on the Coalcon
Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens,
St. Clair County, Illinois, 2-20 August 1976.

Species

Zenaida macroura
(mourning dove)
Vireo gilvus
(warbling vireo)
Setophaga ruticilla
(American redstart)

Table 11. Migratory birds found on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois, during spring and summer, 1976.

Species	Spring ^a	Summer ^b
<u>Anas crecca</u> (green-winged teal)		x
<u>Anas discors</u> (blue-winged teal)		x
<u>Charadrius semipalmatus</u> (semipalmated plover)		x
<u>Actinias macularia</u> (spotted sandpiper)	x	
<u>Tringa solitaria</u> (solitary sandpiper)		x
<u>Tringa melanoleucus</u> (greater yellowlegs)		x
<u>Tringa flavipes</u> (lesser yellowlegs)	x	x
<u>Calidris melanotos</u> (pectoral sandpiper)		x
<u>Calidris bairdii</u> (Baird's sandpiper)		x
<u>Calidris minutilla</u> (least sandpiper)		x
<u>Calidris pusillus</u> (semipalmated sandpiper)	x	
<u>Limnodromus griseus</u> (short-billed dowitcher)		x
<u>Micropalma himantopus</u> (stilt sandpiper)		x
<u>Empidonax alnorum</u> (alder flycatcher)	x	
<u>Empidonax minimus</u> (least flycatcher)	x	
<u>Nuttallornis borealis</u> (olive-sided flycatcher)	x	
<u>Catharus ustulata</u> (Swainson's thrush)	x	
<u>Catharus minima</u> (gray-cheeked thrush)	x	
<u>Vireo philadelphicus</u> (Philadelphia vireo)	x	
<u>Seiurus aurocapillus</u> (ovenbird)	x	
<u>Vermivora peregrina</u> (Tennessee warbler)	x	
<u>Vermivora ruficapilla</u> (Nashville warbler)	x	

Table 11. Continued.

Species	Spring ^a	Summer ^b
<u>Dendroica petechia</u> (yellow warbler)		x
<u>Dendroica magnolia</u> (magnolia warbler)	x	
<u>Dendroica fusca</u> (blackburnian warbler)	x	
<u>Dendroica castanea</u> (bay-breasted warbler)	x	
<u>Dendroica striata</u> (blackpoll warbler)	x	
<u>Oporornis philadelphia</u> (mourning warbler)	x	
<u>Oporornis agilis</u> (Connecticut warbler)	x	
<u>Wilsonia canadensis</u> (Canada warbler)	x	
<u>Dolichonyx oryzivorus</u> (bobolink)	x	
<u>Pheucticus ludovicianus</u> (rose-breasted grosbeak)	x	
<u>Passerculus sandwichensis</u> (savannah sparrow)	x	
<u>Zonotrichia leucophrys</u> (white-crowned sparrow)	x	
<u>Melospiza lincolni</u> (Lincoln's sparrow)	x	

^aMay-June 1976^bAugust 1976

Six species of woodpeckers, including common flickers, and pileated, red-bellied, red-headed, downy, and hairy woodpeckers, were observed in all woodlands where they fed and presumably nested. Species that were observed along transects, but were not common included: bobwhites, yellow-billed cuckoos, great crested flycatchers, eastern wood pewees, blue jays, house wrens, and grasshopper sparrows. Killdeer were seen during both seasons and were most abundant in field type 1. Mourning doves were observed in both seasons also and were more abundant in woodlands.

In spring 46 additional species of birds were observed in areas other than along transects (Table 7); 40 additional species were observed in summer (Table 8). These included a pied-billed grebe, mallards, wood ducks, a turkey vulture, a Mississippi kite, American kestrels, red-tailed hawks, belted kingfishers, a great egret, great blue herons, little blue herons, green herons, and numerous migrating shorebirds (Table 11). In spring, a hen mallard and two hen wood ducks were observed with broods in ponds west of woodland B and, along with belted kingfishers, probably nested on the area (Table 7). The Mississippi kite was observed as it flew over the area; breeding populations of this species in Illinois were listed as vulnerable by the Illinois Nature Preserves Commission (1976). Pairs of red-tailed hawks were seen near woodland B and may have nested there as a juvenile also was seen in that woodland in summer. The herons used the area in summer for feeding and probably dispersed from a large heronry on the Mississippi River near St. Louis, Missouri.

Purple martins and barn, bank, and rough-winged swallows frequently were seen feeding over the area (Table 7). One colony of bank swallows nested in the levee, which eroded and exposed several cavities and an egg.

Bank swallows characteristically nest in cavities at the end of 2- to 3-foot burrows near the top of steep banks; they frequently abandon incomplete burrows (Bent 1942, Pough 1951). Bank and rough-winged swallows may have nested also along banks of the active strip-mine.

Species Which May Occur on the Area

The literature was searched to determine species which may have occurred on the area, their relative abundance, and their population status. For mammals, Barbour and Davis (1969), Hoffmeister and Mohr (1972), Illinois Department of Transportation (1975), Illinois Nature Preserves Commission (1976), Office of Endangered Species and International Activities (1973), and Office of the Federal Register (1975, 1976) were used. The birds which may have occurred on the area and their relative abundances were determined also by a search of the literature. Data were compiled from American Ornithologists' Union (1957, 1973), George (1968), Kleen and Bush (1971), and Terpening et al. (1973).

Mammals

Hoffmeister and Mohr (1972), who compiled the most recent state-wide list of Illinois mammals, recorded 59 species. Thirty-six of these were either abundant throughout the state or occurred in restricted areas throughout the state. Others limited by habitat requirements had very restricted distributions. Forty species of mammals whose range included St. Clair County may have occurred on the study area (Table 12).

Presence of 30 species was documented; 28 were wild mammals, while 2, dogs and cats, were domestics. Ten species of bats could have occurred on the area. Their presence or absence was not documented due to unsuccessful mist netting. Of the seven species not recorded, the Indiana, gray, and evening bats were least likely to occur, because, for the former two, St. Clair County was on the edge of their range; and, for the latter, its occurrence has been recorded as sporadic (Hoffmeister and Mohr 1972). Other species that were not recorded on the area included eastern chipmunks, southern flying squirrels, plains pocket gophers, river otters, and badgers. The latter three species had restricted distributions and were intolerant of

Table 12. Species of mammals which may occur on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois.

Species	Illinois Distribution	Status
Family: Didelphidae		
* <u>Didelphis marsupialis</u> (opossum)	throughout ^{a,b,d}	common ^a
Family: Talpidae		
* <u>Scalopus aquaticus</u> (eastern mole)	throughout, except NE corner ^{a,b}	common ^a
Family: Soricidae		
* <u>Blarina brevicauda</u> (short-tailed shrew)	throughout ^{a,b}	common ^a
* <u>Cryptotis parva</u> (least shrew)	probably statewide ^{a,b}	rare in No. 1/4 ^a
Family: Vespertilionidae		
<u>Myotis lucifugus</u> (little brown bat)	throughout ^{a,b,c}	most common bat in Ill., absent from some locals in summer ^a , not particularly common in any season ^d
<u>Myotis grisescens</u> (gray bat)	Pike, Hardin counties, likely in So. 1/2 ^{a,c} So. 1/4 ^b	Highly vulnerable ^f Endangered ^g
<u>Myotis keenii</u> (Keen's bat)	throughout ^{a,b,c}	few records from Ill. ^a
<u>Myotis sodalis</u> (Indiana bat)	Hardin, LaSalle, Union, JoDaviess, Jackson counties ^{a,b,c,d}	uncommon ^a , endangered ^{f,g,h}
<u>Lasionycteris noctivagans</u> (silver haired bat)	throughout ^{a,b,c,d}	moderately common in summer ^a
* <u>Pipistrellus subflavus</u> (eastern pipistrel)	throughout ^{a,b,c}	common, especially So. 1/2 ^{a,d}
* <u>Eptesicus fuscus</u> (big brown bat)	throughout ^{a,b,c}	widely distributed ^a
* <u>Lasiurus borealis</u> (red bat)	throughout ^{a,b,c}	common in summer ^{a,d}

Table 12. Continued.

Species	Illinois Distribution	Status
<u>Lasiurus cinereus</u> (hoary bat)	throughout ^{a,b,c}	rare ^a
<u>Nycticeius humeralis</u> (evening bat)	NE and So. Ill. ^{a,b,c}	locally abundant ^a
Family: Procyonidae		
* <u>Procyon lotor</u> (raccoon)	throughout ^{a,b,d}	common ^{a,d}
Family: Mustelidae		
* <u>Mustela frenata</u> (long-tailed weasel)	throughout ^{a,b}	
* <u>Mustela vison</u> (mink)	throughout ^{a,b}	fairly common ^a
<u>Lutra canadensis</u> (river otter)	all except NE Ill. ^{a,b}	sporadic ^a
* <u>Mephitis mephitis</u> (striped skunk)	throughout ^{a,b}	moderately common ^a
<u>Taxidea taxus</u> (badger)	No. 1/2 to Fulton and Douglas counties ^a , Randolph, Washington counties ^e	locally common in NW Ill. ^a
Family: Canidae		
* <u>Vulpes fulva</u> (red fox)	throughout ^{a,b}	common ^a , less common than gray fox ^d
* <u>Urocyon cinereoargenteus</u> (gray fox)	throughout ^{a,b}	common in heavily wooded areas ^a
* <u>Canis latrans</u> (coyote)	much of Ill. ^a No. 4/5 ^b	
Family: Sciuridae		
* <u>Marmota monax</u> (woodchuck)	throughout ^{a,b}	common, except in level black-soil areas ^a
<u>Tamias striatus</u> (eastern chipmunk)	may occur in all counties ^{a,b}	localized populations in So. Ill. ^d

Table 12. Continued.

Species	Illinois Distribution	Status
* <u>Sciurus carolinensis</u> (eastern gray squirrel)	throughout ^{a,b}	fairly common in wooded areas ^a
* <u>Sciurus niger</u> (eastern fox squirrel)	throughout ^{a,b}	
<u>Glaucomys volans</u> (southern flying squirrel)	throughout ^{a,b,d}	common in mature woodlands ^{a,d}
Family: Geomyidae		
<u>Geomys bursarius</u> (plains pocket gopher)	Ea. and So. of Ill. and Kankakee R. and Madison county ^{a,b,e}	abundant in sandy and black soils ^a
Family: Castoridae		
* <u>Castor canadensis</u> (beaver)	at least 1/2 counties of Ill. ^a , throughout ^b	
Family: Cricetidae		
* <u>Peromyscus maniculatus</u> (deer mouse)	throughout ^{a,b}	locally abundant ^a
* <u>Peromyscus leucopus</u> (white-footed mouse)	throughout ^{a,b}	abundant ^{a,d}
* <u>Microtus ochrogaster</u> (prairie vole)	throughout ^{a,b}	most abundant in central and So. Ill. ^a
* <u>Pitymys pinetorum</u> (pine vole)	throughout ^{a,b}	sporadic, usually uncommon ^a
* <u>Ondatra zibethicus</u> (muskrat)	throughout ^{a,b}	most common in No. Ill. ^a
Family: Muridae		
* <u>Rattus norvegicus</u> (Norway rat)	throughout ^a	abundant ^a
* <u>Mus musculus</u> (house mouse)	throughout ^a	abundant ^a

Table 12. Continued.

Species	Illinois Distribution	Status
Family: Zapodidae		
* <u>Zapus hudsonius</u> (meadow jumping mouse)	throughout ^{a,b}	not abundant ^a
Family: Leporidae		
* <u>Sylvilagus floridanus</u> (eastern cottontail)	throughout ^{a,b}	common ^a
Family: Cervidae		
* <u>Odocoileus virginianus</u> (white-tailed deer)	throughout ^{b,i}	more abundant in Ea. black prairie counties ⁱ

*Presence on the study area verified.

^aHoffmeister and Mohr (1972)

^bHall and Kelson (1959)

^cBarbour and Davis (1969)

^dLayne (1958)

^eKlimstra and Roseberry (1969)

^fIllinois Nature Preserves Commission (1976)

^gOffice of the Federal Register (1975, 1976)

^hIllinois Dept. Transportation (1975)

ⁱCalhoun and Loomis (1974)

human disturbance. Eastern chipmunks and southern flying squirrels were limited by the scarcity of mast-producing trees. Southern flying squirrels were limited further by the absence of den trees.

Birds

Of the 227 species of birds which may have occurred on the study area, the presence of 121 species was verified (Table 13). Some of these were migratory (Table 11), while others were permanent residents that bred on the area (Tables 9, 10). Rare birds were those which were seldom found in southern Illinois, uncommon ones could have been found in preferred habitats during a portion of the year, and common birds were those present in large numbers in preferred habitats.

Forty-seven species of birds which may have occurred on the area were common summer residents; 38 of these were observed. Thirty-two of the 36 species which were common permanent residents were observed. A greater number of species would have been recorded if censuses were conducted throughout the year, because many species of migratory birds occurred within the area at times other than May through August. Canada geese, black ducks, pintails, northern shovelers, redheads, ring-necked ducks, lesser scaup, common goldeneyes, common and hooded mergansers were listed as common migrants in the St. Clair County area; winter censuses would have included these species (Table 13). Woodward-Clyde Consultants (1976b) reported mallards, gadwalls, green-winged teal, blue-winged teal, wood ducks, and canvasbacks on the area between September 1975 and February 1976. Only three species of raptors were observed; the remainder were rare or uncommon in St. Clair County. Other species observed included little blue herons, a Mississippi kite, black billed cuckoos, a willow flycatcher, blue grosbeaks,

Table 13. Species of birds which may occur on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, New Athens, St. Clair County, Illinois.^c

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
Order: Gaviiformes					
Family: Gaviidae					
<u>Gavia immer</u> (Brunnich)			U ^b		13
(common loon)					
Order: Podicipediformes					
Family: Podicipedidae					
<u>Podiceps auritus cornutus</u> Gmelin			U	R	13
(horned grebe)					
* <u>Podilymbus podiceps podiceps</u> (Linnaeus)	R		C		6, 13
(pied-billed grebe)					
Order: Pelecaniformes					
Family: Phalacrocoracidae					
<u>Phalacrocorax auritus auritus</u> (Lesson)	R		R		14
(double-crested cormorant)					
Order: Anseriformes					
Family: Anatidae					
<u>Branta canadensis interior</u> Todd					
<u>B. c. maxima</u> Delacour			C	C	13
<u>B. c. hutchinsii</u> (Richardson)			C		13, 14
(Canada goose)					
<u>Chen caerulescens caerulescens</u> (Linnaeus)			C		13, 14
(snow goose)					
* <u>Anas platyrhynchos platyrhynchos</u> Linnaeus	U		C	U	13
(mallard)					
<u>Anas rubripes</u> Brewster			C	U	13
(black duck)					

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Anas acuta</u> Linnaeus (pintail)			C	C	13
<u>Anas strepera</u> Linnaeus (gadwall)			U	U	13
<u>Anas americana</u> Gmelin (American widgeon)			U	U	13
<u>Anas clypeata</u> (Linnaeus) (northern shoveler)			C		6, 13
<u>Anas discors</u> discors Linnaeus (blue-winged teal)		R	C		6, 13
<u>Anas crecca carolinensis</u> Gmelin (green-winged teal)			C	R	13, 14
* <u>Aix sponsa</u> (Linnaeus) (wood duck)		C	C		13, 14
<u>Aythya americana</u> (Eyton) (redhead)			C	U	13
<u>Aythya valisineria</u> (Wilson) (canvas back)			U	U	13
<u>Aythya collaris</u> (Donovan) (ring-necked duck)			C	U	13
<u>Aythya affinis</u> (Eyton) (lesser scaup)			C	C	13
<u>Bucephala clangula americana</u> (Bonaparte) (common goldeneye)			C	C	13, 14
<u>Bucephala albeola</u> (Linnaeus) (bufflehead)			U	R	13
<u>Oxyura jamaicensis rubida</u> (Wilson) (ruddy duck)			U	R	13
<u>Mergus merganser americanus</u> Linnaeus (common merganser)			C	C	13, 14

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Mergus serrator</u> Linnaeus (red-breasted merganser)			U	R	13
<u>Lophodytes cucullatus</u> (Linnaeus) (hooded merganser)		R	C	U	2, 13
Order: Falconiformes					
Family: Cathartidae					
* <u>Cathartes aura septentrionalis</u> Wied (turkey vulture)		C		R	10, 11
<u>Coragyps atratus</u> (Bechstein) (black vulture)	R				5, 10
Family: Accipitridae					
* <u>Ictinia mississippiensis</u> (Wilson) (Mississippi kite)		R			14
<u>Accipiter cooperi</u> (Bonaparte) (Cooper's hawk)	U		U		4, 8
<u>Accipiter striatus velox</u> (Wilson) (sharp-shinned hawk)	R		U		4, 8
<u>Circus cyaneus hudsonius</u> (Linnaeus) (marsh hawk)		R	C	U	5
<u>Buteo lagopus sancti-johannis</u> (Gmelin) (rough-legged hawk)			U	R	5
* <u>Buteo jamaicensis borealis</u> (Gmelin) <u>B. j. kriderii</u> Hoopes <u>B. j. calurus</u> (Cassin) (red-tailed hawk)	C		C		5, 8
<u>Buteo lineatus lineatus</u> (Gmelin) (red-shouldered hawk)	R		R	R	1, 8
<u>Buteo platypterus platypterus</u> (Vieillot) (broad-winged hawk)		"	C		4

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
Family: Pandionidae					
<u>Pandion haliaetus carolinensis</u> (Gmelin)		R	C		13, 14
(osprey)					
Family: Falconidae					
<u>Falco peregrina anatum</u> Bonaparte			R		14
(peregrine falcon)					
<u>Falco columbarius columbarius</u> Linnaeus			R	R	14
(merlin)					
* <u>Falco sparverius sparverius</u> Linnaeus					
<u>F. s. richardsonii</u> Ridgway	C		C	C	5, 10
(American kestrel)					
Order: Galiformes					
Family: Phasianidae					
* <u>Colinus virginianus virginianus</u> (Linnaeus)	C				5, 8
(bobwhite)					
Order: Ciconiiformes					
Family: Ardeidae					
* <u>Casmerodius albus egretta</u> (Gmelin)		C	C		6
(great egret)					
<u>Egretta thula thula</u> (Molina)			U		6
(snowy egret)					
<u>Bubulcus ibis ibis</u> Linnaeus		R			10, 11
(cattle egret)					
* <u>Ardea herodias wardi</u> Ridgway					
(great blue heron)					
* <u>Florida caerulea caerulea</u> (Linnaeus)	R		C		6, 14
(little blue heron)					
* <u>Butorides virescens virescens</u> (Linnaeus)		R	C		6
(green heron)					
<u>Nycticorax nycticorax hoactli</u> (Gmelin)		C	C		6, 14
(black-crowned night heron)	U		C		6

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
Order: Gruiformes					
Family: Rallidae					
<u>Fulica americana americana</u> Gmelin (American coot)		U	C	C	6, 13
Order: Charadriiformes					
Family: Charadriidae					
<u>Pluvialis dominica dominica</u> (Muller) (American golden plover)			U		9, 10
* <u>Charadrius semipalmatus</u> Bonaparte (semipalmated plover)			U		9
* <u>Charadrius vociferus vociferus</u> Linnaeus (killdeer)	C				9, 10
Family: Scolopacidae					
<u>Bartramia longicauda</u> (Bechstein) (upland sandpiper)		C	C		7
<u>Philohela minor</u> (Gmelin) (American woodcock)		U	R	R	5, 8
<u>Capella gallinago delicata</u> (Ord) (common snipe)			U	R	1, 2, 10
<u>Tringa solitaria solitaria</u> Wilson					
* <u>T. s. cinnamomea</u> (Brewster) (solitary sandpiper)			C		9, 13
* <u>Actinias macularia</u> (Linnaeus) (spotted sandpiper)		R	C		9, 13
* <u>Tringa melanoleucus</u> (Gmelin) (greater yellowlegs)			C		6, 9
* <u>Tringa flavipes</u> (Gmelin) (lesser yellowlegs)			C		6, 9
* <u>Micropalma himantopus</u> (Bonaparte) (stilt sandpiper)			R		9
<u>Limnodromus griseus hendersoni</u> Rowan					
* <u>L. g. griseus</u> (Gmelin) (short-billed dowitcher)			U		9
* <u>Calidris melanotos</u> (Vieillot) (pectoral sandpiper)			C		9, 10



Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Calidris alpina pacifica</u> (Coues) (dunlin)			R		9
<u>Calidris alba</u> (Pallas) (sanderling)			R		9
* <u>Calidris bairdii</u> (Coues) (Baird's sandpiper)			R		9
* <u>Calidris minutilla</u> (Vieillot) (least sandpiper)			C		9
* <u>Calidris pusillus</u> (Linnaeus) (semipalmated sandpiper)			C		9
<u>Calidris mauri</u> Cabanis (western sandpiper)			R		9
Family Phalaropodidae					
<u>Steganopus tricolor</u> Vieillot (Wilson's phalarope)			R		13
Family Laridae					
<u>Larus argentatus smithsonianus</u> Coues (herring gull)		R	C	C	13, 14
<u>Larus delawarensis</u> Ord (ring-billed gull)		R	C	C	13, 14
<u>Larus pipixcan</u> Wagler (Franklin's gull)			U		6, 11
<u>Larus philadelphia</u> (Ord) (Bonaparte's gull)			U		13
<u>Sterna hirundo hirundo</u> Linnaeus (common tern)		R	C		13
<u>Sterna forsteri</u> Nuttall (Forster's tern)			U		13
<u>Chlidonias niger surinamensis</u> (Gmelin) (black tern)			C		13
Order: Columbiformes					
Family: Columbidae					
<u>Columba livia</u> Gmelin (rock dove)	C				5, 10
* <u>Zenaidura macroura carolinensis</u> (Linnaeus) (mourning dove)	C		C		3, 5

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
Order: Cuculiformes					
Family: Cuculidae					
* <u>Coccyzus americanus americanus</u> (Linnaeus)		C	C		4, 8
(yellow-billed cuckoo)					
* <u>Coccyzus erythrophthalmus</u> (Wilson)		R	U		4, 8
(black-billed cuckoo)					
Order: Strigiformes					
Family: Tytonidae					
<u>Tyto alba pratincola</u> (Bonaparte)	R				8
(barn owl)					
Family: Strigidae					
<u>Otus asio asio</u> (Linnaeus)					4
<u>O. a. naevius</u> (Gmelin)	C				4
(screech owl)					
* <u>Bubo virginianus virginianus</u> (Gmelin)	C				1, 4
(great horned owl)					
* <u>Strix varia varia</u> Barton	C				5
(barred owl)					
<u>Asio flammeus flammeus</u> (Pontoppidan)			U		
(short-eared owl)					
Order: Caprimulgiformes					
Family: Caprimulgidae					
<u>Caprimulgus carolinensis</u> Gmelin		C			1
(Chuck-will's-widow)					
<u>Caprimulgus vociferus vociferus</u> Wilson		C			4
(whip-poor-will)					
* <u>Chordeiles minor chapmani</u> Coues		C	C		3, 5
(common nighthawk)					

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
Order: Apodiformes					
Family: Apodidae					
* <u>Chaetura pelagica</u> (Linnaeus) (chimney swift)	C	C	C		15
Family: Trochilidae					
* <u>Archilochus colubris</u> (Linnaeus) (ruby-throated hummingbird)	C	C	C		1, 15
Order: Coraciiformes					
Family: Alcedinidae					
* <u>Megasceryle alcyon alcyon</u> (Linnaeus) (belted kingfisher)	C				13, 14
Order: Piciformes					
Family: Picidae					
* <u>Colaptes auratus borealis</u> Ridgway <u>C. a. luteus</u> Bangs (common flicker)	C		C		8, 15
* <u>Dryocopus pileatus pileatus</u> (Linnaeus) (pileated woodpecker)	C				1
* <u>Centurus carolinus zebra</u> (Boddaert) (red-bellied woodpecker)	C				1, 4
* <u>Melanerpes erythrocephalus erythrocephalus</u> (Linnaeus) (red-headed woodpecker)	C				4
<u>Sphyrapicus varius varius</u> (Linnaeus) (yellow-bellied sapsucker)			C	C	1, 4
* <u>Dendrocopos villosus audobonii</u> (Swainson) <u>D. v. villosus</u> (Linnaeus) (hairy woodpecker)	C				1, 4
* <u>Dendrocopos pubescens medianus</u> (Swainson) (downy woodpecker)	C				1, 4

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
Order: Passeriformes					
Family: Tyrannidae					
* <u>Tyrannus tyrannus</u> (Linnaeus) (eastern kingbird)		C	C		8
* <u>Myiarchus crinitus</u> boreus Bangs (great crested flycatcher)		C	C		4
* <u>Sayornis phoebe</u> (Latham) (eastern phoebe)		C	C		8
<u>Empidonax flaviventris</u> (Baird & Baird) (yellow-bellied flycatcher)			U		1, 2, 4
* <u>Empidonax virescens</u> (Vieillot) (acadian flycatcher)		C	C		1, 4
* <u>Empidonax traillii traillii</u> (Audubon) (willow flycatcher)		R	R		1, 2
* <u>Empidonax alnorum</u> Brewster (alder flycatcher)			R		1, 2
* <u>Empidonax minimus</u> (Baird & Baird) (least flycatcher)			C		8
* <u>Contopus virens</u> (Linnaeus) (eastern wood pewee)		C	C		4
* <u>Nuttallornis borealis</u> (Swainson) (olive-sided flycatcher)			R		1, 2
Family: Alaudidae					
* <u>Eremophila alpestris praticola</u> (Henshaw) (horned lark)	C				11
Family: Hirundinidae					
* <u>Hirundo rustica erythrogaster</u> Boddaert (barn swallow)		C	C		7, 13
<u>Petrochelidon pyrrhonota pyrrhonota</u> (Vieillot) (cliff swallow)		U	U		7, 13
<u>Iridoprocne bicolor</u> (Vieillot) (tree swallow)		U	C		13

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
* <u>Riparia riparia riparia</u> (Linnaeus) (bank swallow)		U	C		13
* <u>Stelgidopteryx ruficollis serripennis</u> (Audubon) (rough-winged swallow)		C	C		13
* <u>Progne subis subis</u> (Linnaeus) (purple martin)		C	C		15
Family: Corvidae					
* <u>Cyanocitta cristata bromia</u> Oberholser					
<u>C. c. cristata</u> (Linnaeus) (blue jay)	C				4, 15
* <u>Corvus brachyrhynchos brachyrhynchos</u> Brehm (common crow)	C				3, 11
Family: Paridae					
<u>Parus atricapillus atricapillus</u> Linnaeus (black-capped chickadee)				U	8
* <u>Parus carolinensis extimus</u> (Todd & Sutton) (Carolina chickadee)	C				4, 12
* <u>Parus bicolor</u> Linnaeus (tufted titmouse)	C				1, 4
Family: Sittidae					
* <u>Sitta carolinensis cooki</u> Oberholser (white-breasted nuthatch)	C				4
<u>Sitta canadensis</u> Linnaeus (red-breasted nuthatch)			U	R	12
Family: Certhiidae					
<u>Certhia familiaris americana</u> Bonaparte (brown creeper)		R	C	C	4, 12
Family: Troglodytidae					
* <u>Troglodytes aedon baldwini</u> Oberholser (house wren)	C	C	C		8, 15

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Troglodytes troglodytes hiemalis</u> Vieillot (winter wren)			U	U	1, 4
<u>Thryomanes bewickii bewickii</u> Audubon					
<u>T. b. altus</u> Aldrich (Bewick's wren)	R		U		8
* <u>Thryothorus ludovicianus ludovicianus</u> (Latham) (Carolina wren)	C				1, 8
Family: Mimidae					
* <u>Mimus polyglottos polyglottos</u> (Linnaeus) (mockingbird)	C				8, 15
* <u>Dumetella carolinensis</u> (Linnaeus) (gray catbird)		C	C		8, 15
* <u>Toxostoma rufum rufum</u> (Linnaeus) (brown thrasher)		C	C		8, 15
Family: Turdidae					
* <u>Turdus migratorius migratorius</u> Linnaeus					
<u>T. m. achusterus</u> (Batchelder) (American robin)		C	C	U	4, 15
* <u>Hylocichla mustelina</u> (Gmelin) (wood thrush)		C	C		1, 4
<u>Catharus guttatus faxoni</u> Bangs & Penard (hermit thrush)			C	U	4
* <u>Catharus ustulata swainsoni</u> (Tschudi) (Swainson's thrush)			C		4
* <u>Catharus minima minima</u> (Lafresnaye) <u>C. m. bicknelli</u> Ridgway (gray-cheeked thrush)			U		4
<u>Hylocichla fuscescens salicicola</u> Ridgway (veery)			U		1, 4

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
* <u>Sialia sialis sialis</u> (Linnaeus) (eastern bluebird)	C				3, 8
Family: Sylviidae					
* <u>Polioptila caerulea caerulea</u> (Linnaeus) (blue-gray gnatcatcher)		C	C		1
<u>Regulus satrapa satrapa</u> Lichtenstein (golden-crowned kinglet)			C	C	4
<u>Regulus calendula calendula</u> (Linnaeus) (ruby-crowned kinglet)			C	R	1, 12
Family: Motacillidae					
<u>Anthus spinoletta rubescens</u> (Tunstall) (water pipit)			U		11
Family: Bombycillidae					
* <u>Bombycilla cedrorum</u> Vieillot (cedar waxwing)		R	C	U	8
Family: Laniidae					
<u>Lanius ludovicianus migrans</u> Palmer (loggerhead shrike)	U		U		8
Family: Sturnidae					
* <u>Sturnus vulgaris vulgaris</u> Linnaeus (starling)	C				3, 8
Family: Vireonidae					
<u>Vireo solitarius solitarius</u> (Wilson) (solitary vireo)			C		4
* <u>Vireo griseus noveboracensis</u> (Gmelin) (white-eyed vireo)		C	C		8
* <u>Vireo bellii bellii</u> Audubon (Bell's vireo)		U			8
* <u>Vireo flavifrons</u> Vieillot (yellow-throated vireo)	C	C	C		4

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>*Vireo olivaceus</u> (Linnaeus)		C	C		4
(red-eyed vireo)					
<u>*Vireo philadelphicus</u> (Cassin)			U		4
(Philadelphia vireo)					
<u>*Vireo gilvus gilvus</u> (Vieillot)		U	U		4
(warbling vireo)					
Family: Parulidae					
<u>*Mniotilta varia</u> (Linnaeus)		R	C		4
(black-and-white warbler)					
<u>*Protonotaria citrea</u> (Boddaert)		C	C		2
(prothonotary warbler)					
<u>Helmitheros vermivorus</u> (Gmelin)		U	U		4
(worm-eating warbler)					
<u>Vermivora chrysoptera</u> (Linnaeus)			U		8
(golden-winged warbler)					
<u>Vermivora pinus</u> (Linnaeus)		R	R		8
(blue-winged warbler)					
<u>*Vermivora peregrina</u> (Wilson)			C		4, 8
(Tennessee warbler)					
<u>Vermivora celata celata</u> (Say)			U		8
(orange-crowned warbler)					
<u>*Vermivora ruficapilla ruficapilla</u> (Wilson)			C		1, 2, 8
(Nashville warbler)					
<u>*Parula americana</u> (Linnaeus)		C	C		1
(parula warbler)					
<u>*Dendroica petechia aestiva</u> (Gmelin)					8
<u>D. p. amnicola</u> Batchelder		C	C		
(yellow warbler)					
<u>*Dendroica magnolia</u> (Wilson)					1, 2, 8
(magnolia warbler)			C		

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Dendroica tigrina</u> (Gmelin) (Cape May warbler)			U		8
<u>Dendroica coronata coronata</u> (Linnaeus) (yellow-rumped warbler)			C	U	1, 8
<u>Dendroica virens virens</u> (Gmelin) (black-throated green warbler)			C		4
<u>Dendroica caerulescens</u> (Gmelin) (black-throated blue warbler)			R		4
<u>Dendroica cerulea</u> (Wilson) (cerulean warbler)		C	C		1, 4
* <u>Dendroica dominica albilora</u> Ridgway (yellow-throated warbler)		C	C		2, 12
* <u>Dendroica fusca</u> (Muller) (blackburnian warbler)			C		4
<u>Dendroica pensylvanica</u> (Linnaeus) (chestnut-sided warbler)			C		8
* <u>Dendroica castanea</u> (Wilson) (bay-breasted warbler)			C		4, 8
* <u>Dendroica striata</u> (Forster) (blackpoll warbler)			C		4, 8
<u>Dendroica discolor discolor</u> (Vieillot) (prairie warbler)		C	C		8, 12
<u>Dendroica palmarum palmarum</u> (Gmelin) <u>D. p. hypochrysea</u> Ridgway (palm warbler)			C		8
* <u>Seiurus aurocapillus furvior</u> Batchelder <u>S. a. aurocapillus</u> (Linnaeus) <u>S. a. cinereus</u> Miller (ovenbird)	R		C		4
<u>Seiurus noveboracensis notabilis</u> Ridgway (northern waterthrush)			C		1, 2

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Seiurus motacilla</u> (Vieillot)		C	C		1
(Louisiana waterthrush)					
* <u>Geothlypis trichas brachidactylus</u> (Swainson)		C	C		1, 2, 6
(common yellowthroat)					
* <u>Icteria virens virens</u> (Linnaeus)		C	C		8
(yellow-breasted chat)					
* <u>Oporornis formosus</u> (Wilson)		C	C		4
(Kentucky warbler)					
* <u>Oporornis philadelphia</u> (Wilson)			U		8
(mourning warbler)					
* <u>Oporornis agilis</u> (Wilson)			R		8
(Connecticut warbler)					
<u>Wilsonia citrina</u> (Boddaert)		R	R		2
(hooded warbler)					
<u>Wilsonia pusilla pusilla</u> (Wilson)			U		1, 2, 8
(Wilson's warbler)					
* <u>Wilsonia canadensis</u> (Linnaeus)			C		1, 2
(Canada warbler)					
* <u>Setophaga ruticilla ruticilla</u> (Linnaeus)		C	C		1, 4
(American redstart)					
Family: Ploceidae					
<u>Passer domesticus domesticus</u> (Linnaeus)	C				15
(house sparrow)					
<u>Passer montanus montanus</u> (Linnaeus)	C				15
(European tree sparrow)					
Family: Icteridae					
* <u>Dolichonyx oryzivorus</u> (Linnaeus)			U		6, 7
(bobolink)					
* <u>Sturnella magna magna</u> (Linnaeus)					
<u>S. m. argutula</u> Bangs	C		C		7, 10
(eastern meadowlark)					

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Sturnella neglecta neglecta</u> Audubon (western meadowlark)				R	7, 10
* <u>Agelaius phoeniceus phoeniceus</u> (Linnaeus) (red-winged blackbird)	C		C		3, 6
<u>Euphagus cyanocephalus</u> (Wagler) (Brewer's blackbird)			R		3, 5
<u>Euphagus carolinus carolinus</u> (Muller) (rusty blackbird)			C	U	1
* <u>Quiscalus quiscula versicolor</u> Vieillot (common grackle)	C		C		3, 11
* <u>Molothrus ater ater</u> (Boddaert) (brown-headed cowbird)	C		C		3, 11
* <u>Icterus spurius</u> (Linnaeus) (orchard oriole)		C	C		8
* <u>Icterus galbula galbula</u> (Linnaeus) (northern oriole)		C	C		8, 15
Family: <u>Thraupidae</u>					
* <u>Piranga olivacea</u> (Gmelin) (scarlet tanager)		U	C		1, 4
* <u>Piranga rubra rubra</u> (Linnaeus) (summer tanager)		C	C		4
Family: <u>Fringillidae</u>					
* <u>Cardinalis cardinalis cardinalis</u> (Linnaeus) (cardinal)	C				8, 15
* <u>Pheucticus ludovicianus</u> (Linnaeus) (rose-breasted grosbeak)			C		4
<u>Hesperiphona vespertina vespertina</u> (Cooper) (evening grosbeak)			R		15
* <u>Guiraca caerulea caerulea</u> (Linnaeus) (blue grosbeak)		R	U		8

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>*Passerina cyanea</u> (Linnaeus) (indigo bunting)		C	C		8
<u>Carpodacus purpureus</u> <u>purpureus</u> (Gmelin) (purple finch)			C	C	15
<u>Spinus pinus</u> <u>pinus</u> (Wilson) (pine siskin)			U	U	15
<u>*Spinus tristis</u> <u>tristis</u> (Linnaeus) (American goldfinch)	C		C		8, 15
<u>*Spiza americana</u> (Gmelin) (dickcissel)		C	C		7, 15
<u>*Pipilo erythrophthalmus</u> <u>erythrophthalmus</u> (Linnaeus) (rufous-sided towhee)		C	C	U	8, 15
<u>*Passerculus sandwichensis</u> <u>labradorius</u> Howe <u>P. s. savanna</u> (Wilson)		U	C		5, 7
<u>P. s. oblitus</u> Peters & Griscom (savannah sparrow)		C	C	U	7
<u>*Ammodramus savannarum</u> <u>pratensis</u> (Vieillot) (grasshopper sparrow)			R		5
<u>Ammodramus henslowii</u> <u>henslowii</u> (Audubon) (Henslow's sparrow)			R		6
<u>Ammodramus lecontei</u> (Audubon) (LeConte's sparrow)		U	U		5, 7
<u>Poocetes gramineus</u> <u>gramineus</u> (Gmelin) (vesper sparrow)		R	R		8
<u>*Chondestes grammacus</u> <u>grammacus</u> (Say) (lark sparrow)			C	C	5, 8
<u>Junco hyemalis</u> <u>hyemalis</u> (Linnaeus) (dark-eyed junco)			C	C	5, 8
<u>Spizella arborea</u> <u>arborea</u> (Wilson) (tree sparrow)			C	C	5, 8

Table 13. Continued.

Species	Permanent Resident	Summer Resident	Migrant	Winter Resident	Preferred Habitat
<u>Spizella passerina passerina</u> (Bechstein) (chipping sparrow)		C	C		8, 15
* <u>Spizella pusilla pusilla</u> (Wilson) (field sparrow)	C		C		5, 8
<u>Zonotrichia querula</u> (Nuttall) (Harris's sparrow)			R	R	5, 8
* <u>Zonotrichia leucophrys leucophrys</u> (Forster) (white-crowned sparrow)			C	C	5, 8
<u>Zonotrichia albicollis</u> (Gmelin) (white-throated sparrow)			C	C	1, 8
<u>Passerella iliaca iliaca</u> (Merrem) (fox sparrow)			C	C	1, 8
* <u>Melospiza lincolni lincolni</u> (Audubon) (Lincoln's sparrow)			U		8
<u>Melospiza georgiana georgiana</u> (Latham) <u>M. g. ericrypta</u> Oberholser (swamp sparrow)			C	C	6, 8
<u>Melospiza melodia melodia</u> (Wilson) (song sparrow)	C		C		8
<u>Calcaricus lapponicus lapponicus</u> (Linnaeus) (lapland longspur)			U		5

* Presence verified on the study site.

- 1 bottomland forests
- 2 bottomland swamps
- 3 cultivated fields
- 4 deciduous woods
- 5 fallow fields
- 6 marshes
- 7 hayfields
- 8 hedgerows, wood margins, shrubs

- 9 mudflats
- 10 pastures
- 11 plowed fields
- 12 pine woods
- 13 reservoirs, lakes, ponds
- 14 rivers
- 15 residential areas
- b C common occurrence
- U uncommon occurrence
- R rare occurrence

c Potential occurrence and status in St. Clair County was based on reports by American Ornithologists' Union (1957, 1973), George (1968), Kleen and Bush (1971), and Terpening et al. (1973).

and a lark sparrow, all of which were rare summer residents. Most of the species not observed were rare or uncommon or were near the limit of their distribution in St. Clair County, and thus observation of them would have been unlikely.

Endangered, Highly Vulnerable, Vulnerable,
Rare, Restricted, and Species of Uncertain Status

The Department of the Interior (Office of the Federal Register 1975) designated rare and endangered animals of the United States; and, the Illinois Nature Preserves Commission (1976) prepared a similar list for the State of Illinois. Within the state system, endangered species were those with populations near extinction throughout all or a significant part of their range. Those occurring within the state did not necessarily breed in Illinois, but were found here at some time during their lives. Highly vulnerable species were those with breeding populations near extirpation in the state, whereas vulnerable species were those with populations approaching extirpation as a result of habitat degradation or destruction, loss of specific habitat requirements, restricted distributions, sport hunting, commercial or scientific collecting, or other reasons. Species classified as rare, restricted, or of uncertain status were those present in very low numbers, restricted to very limited portions of the state, or with insufficient information at the time to be categorized. Under this system, the status of a species could change as habitats were altered and as new studies contributed information about their population abundance, distribution, and requirements.

Two species of mammals which may have occurred on the New Athens study area were endangered: the Indiana bat and the gray bat. The river otter (Lutra canadensis) may have occurred on the study area and was classified as vulnerable. Populations of 12 other species, declining in Illinois, did not range into the study area. Of these, the eastern woodrat (Neotoma floridana), was considered highly vulnerable, while the bobcat (Lynx rufus), and white-tailed jackrabbit (Lepus townsendii) were considered vulnerable.

Species of rare, restricted or uncertain status included the southeastern shrew (Sorex longirostris), southeastern bat (Myotis austroriparius), hoary bat (Lasiurus cinereus), eastern big-eared bat (Plecotus rafinesquii), least weasel (Mustela nivalis), cotton mouse (Peromyscus gossypinus), golden mouse (Ochrotomys nuttalli), rice rat (Oryzomys palustris), and pigmy shrew (Microsorex hoyi). None of these had reported ranges that included St. Clair County, Illinois.

Of the birds which may have occurred on the Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site, 1 was endangered, 4 highly vulnerable, 16 vulnerable, and 14 rare, restricted, or of uncertain status. Eleven of these species also occurred on the Blue List, which included those heading toward nationally endangered or threatened status (Anonymous 1974). Although most of these birds did not breed on the study area, many utilized it during migration. Two species (red-shouldered hawk and loggerhead shrike) were categorized as vulnerable only for northern Illinois (Illinois Nature Preserves Comm. 1976). Six species observed on the study area (yellow-billed cuckoo, common nighthawk, hairy woodpecker, purple martin, yellow warbler, and grasshopper sparrow) were on the Blue List, but not for the midwest (Anonymous 1974). Two vulnerable species (Mississippi kite and little blue heron) and two rare, restricted or uncertain status birds (Nashville warbler and mourning warbler) were seen on the area during the study. The current status of species which may occur on the study area is as follows:

Mammals

Myotis sodalis Miller and Allen, Indiana bat

(Endangered)

The Indiana bat, uncommon in Illinois, is endangered throughout its range (Hoffmeister and Mohr 1972, Illinois Dept. Transportation 1975, Illinois Nature Preserves Comm. 1976, Office of the Federal Register 1975). These bats hibernate in caves in Kentucky and Missouri and may be found under bridges, in buildings, and beneath the bark of trees in summer. Presently there are about 110,000 Indiana bats. Their future is doubtful due to commercialization of caves in which they roost, vandalism, and disturbance caused by spelunkers (Barbour and Davis 1969, Office of Endangered Species and Int. Activities 1973). While this species could occur on the study area, St. Clair County is at the edge of its known range, and its occurrence was, therefore, considered unlikely. None was observed.

Myotis grisescens Howell, gray bat

(Endangered)

The gray bat is rare in Illinois (Illinois Dept. Transportation 1975), and is known only from Pike and Hardin counties, but likely ranges throughout southern Illinois (Hoffmeister and Mohr 1972). It was placed on the National Endangered Species list in April, 1976 (Office of the Federal Register 1976). At the northern extremity of the gray bat's range, the Illinois population is considered "highly vulnerable" (Illinois Nature Preserves Comm. 1976). Maternity colonies are found in large caves containing substantial streams, whereas winter colonies are in deep caves with long vertical shafts. Recent human disturbance, including commercialization of caves, threatens this species' existence (Barbour and

Davis 1969). Because the study area was at the edge of this bat's range, occurrence on the area was considered unlikely, and none was observed.

Lutra canadensis (Schreber), river otter

(Vulnerable)

The river otter was once fairly common along large streams in Illinois, but since 1900 has been seen or taken in only 25 counties. Its occurrence in all but the northeastern part of the state is sporadic (Hoffmeister and Mohr 1972) and the breeding population is vulnerable (Illinois Nature Preserves Comm. 1976). The otter has been found along streams and lakes, and usually dens near water. Hoffmeister and Mohr (1972) reported that otters fed on crayfish, frogs, turtles, earthworms, aquatic insects, and fish. Channelization, which destroyed many shallow areas of the Kaskaskia River, may have limited some aquatic species on which otters fed, and probably limited their distribution on the study area. None was recorded during this study.

Birds

Falco peregrinus anatum Bonaparte,
peregrine falcon

(endangered)

This subspecies formerly bred from the non-Arctic portions of Alaska and Canada, south to Baja, California, and east to the Atlantic coast. The breeding distribution of these cliff dwellers is largely controlled by the availability of suitable nesting sites. They have been extirpated as breeding birds from southeastern Canada, eastern and central United States, and local areas in the west. Peregrines winter from southern United States to South America (Pough 1951, Robbins, et al. 1966).

This subspecies has been declared endangered in Illinois (Illinois Dept. of Transportation 1975) and throughout its range (Office of the Federal Register 1975). Formerly this falcon occurred in Illinois during migration with some birds remaining throughout summer. Peregrines no longer breed in Illinois (George 1971) and only 15 to 20 birds migrate along the Illinois and Mississippi Rivers and Lake Michigan (Illinois Dept. of Transportation 1975). None was observed during this study.

Phalacrocorax auritus auritus (Lesson),
double-crested cormorant

(Highly vulnerable)

Double-crested cormorants breed primarily in north-central United States and south-central Canada, and winter in colonies in the Mississippi valley from Tennessee to the Gulf coast (Palmer 1962, Robbins et al. 1966). After breeding, they extend their range to the north, west, and south, and later migrate in small flocks in the Mississippi valley. Cormorants feed on fish, crustaceans, amphibians, and aquatic insects; they nest on rocky islets, cliff edges, and trees adjacent to water (Palmer 1962).

These birds formerly were common as summer residents along the Mississippi and Illinois River in Illinois, but presently are rare breeding

birds and migrants (George 1968, 1971, Illinois Dept. Transportation 1975, Kleen and Bush 1971). They have decreased throughout their range as a result of exploitation by man, habitat destruction, drought, and possibly pesticides (George 1972, Palmer 1962). Only one nesting colony is known from Carroll County (Illinois Dept. Transportation 1975). None was seen on the study area.

Pandion haliaetus carolinensis (Gmelin), osprey (Highly vulnerable)

Ospreys breed from Alaska south to Mexico, and east to the Atlantic coast. They winter from southern United States to South America (Robbins et al. 1966, Office of Endangered Species and Int. Activities 1973). They nest in tall trees and manmade structures near extensive bodies of water, and feed entirely on fish (Pough 1951). Their nationwide decline in the past few decades probably was due to human disturbances while nesting, DDT, and increasing turbidity of waters in which they feed (Pough 1951, George 1971). Some ospreys migrate through southern Illinois (George 1968, Kleen and Bush 1971); but, there have been none nesting in Illinois during the past few years (Illinois Dept. Transportation 1975, Illinois Nature Preserves Comm. 1976). None was seen on the study area.

Egretta thula thula (Molina), snowy egret (Highly vulnerable)

This subspecies breeds in Texas, Oklahoma, the southern Mississippi valley, and along the southern Atlantic coast; it winters in Florida, and Central and South America (Palmer 1962, Robbins et al. 1966). Snowy egrets nest in mixed colonies with other small herons near or over water, and feed on small fish, frogs, snakes, crustaceans, worms, snails, and insects in ponds, lakes, and marshes (Pough 1951, Palmer 1962). Several breeding pairs

occur in Missouri and Madison County, Illinois (Illinois Dept. Transportation 1975). Snowy egrets also are rare to uncommon postbreeding summer residents, and migrants in southern Illinois (George 1968, Kleen and Bush 1971). None was seen on the study area.

Tyto alba pratincola (Bonaparte), barn owl (Highly vulnerable)

Barn owls are permanent residents of the east-central and Pacific coast states (Robbins et al. 1966). They feed on small rodents in open country, and nest in hollow trees, barns, caves, and abandoned buildings (Pough 1951). Formerly uncommon permanent residents throughout Illinois, their population crashed in the early 1960's from unknown causes (Illinois Dept. Transportation 1975). They are now rare residents of northeastern, northwestern, and southeastern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). None was observed on the study area.

Ictinia mississippiensis (Wilson), Mississippi kite (Vulnerable)

Mississippi kites nest in mature timber along lakes and rivers in the Mississippi valley and Gulf coast, and winter in southern Florida to southern Texas, southward (Pough 1951, Robbins et al. 1966). They feed primarily on large insects, some mice, snakes, and toads (Pough 1951). Formerly they were uncommon summer residents in southern Illinois; and, although making a comeback, they are still rare breeders along the Mississippi River in southern and central Illinois (George 1972, Illinois Dept. Transportation 1975, Terpening et al. 1973). Robbins and Erskine (1976) noticed a substantial population increase since 1967. The species was recently recorded from Alexander, Union, Jackson, Randolph, Monroe, and

Jersey Counties (Terpening et al. 1973). One was sighted in flight over woodland B during the study (Table 7).

Accipiter cooperi (Bonaparte), Cooper's hawk (Vulnerable)

This hawk nests throughout the continental United States and southern Canada, and winters from central United States, southward (Robbins et al. 1966). It feeds primarily on birds and small mammals in open woodlands and wood margins (Pough 1951). Formerly it was common as a permanent resident in Illinois; during the late 1940's, being one of the most common birds of prey in the United States (George 1971, Pough 1951). It is currently a rare to uncommon permanent resident and migrant in much of the United States and in southern Illinois where it is found most frequently in the Shawnee National Forest (George 1968, 1971, Illinois Dept. Transportation 1975, Kleen and Bush 1971). There are no explanations for its decline (Terpening et al. 1973). None was seen on the study area.

Accipiter striatus velox (Wilson), sharp-shinned hawk (Vulnerable)

These accipiters nest in woodlands and forests throughout much of the continental United States, southern Canada, and southern Alaska; they winter from central United States, southward (Robbins et al. 1966). They feed on small birds, particularly sparrows and warblers, small mammals, and large insects (Pough 1951). Formerly uncommon as residents and common as migrants, they currently are rare permanent residents, nesting in northern Illinois, and uncommon migrants to southern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). This species has declined nationally (Anonymous 1974). A sharp-shinned hawk was observed in winter on the study area during a previous survey (Woodward-Clyde Consultants 1976b), but was not seen during this study.

Circus cyaneus hudsonius (Linnaeus), marsh hawk

(Vulnerable)

Marsh hawks nest on the ground in grasslands and marshes in the northern half of the United States and the southern two-thirds of Canada and Alaska; they winter from central United States, southward (Pough 1951, Robbins et al. 1966). They primarily feed on small mammals in open fields, marshes, grassy uplands, and meadows (Pough 1951). These harriers formerly were common summer residents of central and northern Illinois; today breeding populations are known only in Grundy County (Illinois Dept. Transportation 1975). Their decline was due to marsh drainage and human disturbances (Anonymous 1974, Pough 1951). Presently, they are very rare summer residents, uncommon to common migrants, and uncommon wintering birds in southern Illinois (George 1968, Kleen and Bush 1971). A marsh hawk was observed on the study site in winter during a previous survey (Woodward-Clyde Consultants 1976b), but was not observed during this sampling period.

Florida caerulea caerulea (Linnaeus), little blue heron

(Vulnerable)

Little blue herons breed in mixed colonies with other herons and egrets in the southern Mississippi valley, Gulf coast, and Atlantic coast. They winter along the Gulf and southern Atlantic coasts southward (Palmer 1962, Robbins et al. 1966). Such a colony exists in the floodplain of the Mississippi River near East St. Louis, and additional colonies occur in Missouri (Illinois Dept. Transportation 1975, Terpening et al. 1973). These birds extend their postbreeding range into the midwest and eastern United States where they feed on crustaceans, fishes, insects, frogs, and snakes in ponds, lakes, marshes, and meadows (Palmer 1962).

These herons have been declining as a breeding species probably due to habitat destruction, and human disturbances (Illinois Dept. Transportation 1975). They are common postbreeding summer visitants and migrants in southern Illinois (George 1968, Kleen and Bush 1971). Several little blue herons were observed during this study feeding along the oxbow and flying over the study area (Tables 7, 8).

Bartramia longicauda (Bechstein), upland sandpiper (Vulnerable)

These sandpipers breed in the prairie regions of north-central United States, Canada, and Alaska, and winter in South America (Pough 1951, Robbins et al. 1966). They nest and feed on insects in short grass prairies, dry uplands, pastures, and hayfields (Pough 1951). Upland sandpipers have declined since the late 1800's due to market hunting and human disturbances (Illinois Dept. Transportation 1975, Pough 1951). They presently occur statewide in small numbers and are relatively common migrants (George 1968, Illinois Dept. Transportation 1975). Since 1969, Robbins and Erskine (1976) have noticed an increasing population of this species. None was seen on the study area.

Steganopus tricolor Vieillot, Wilson's phalarope (Vulnerable)

This species nests along prairie sloughs and swamps in northwestern United States and southwestern Canada (Robbins et al. 1966). It feeds on terrestrial and aquatic insects in wet meadows, mudflats,

and shallow water; it winters in South America (Pough 1951). Its breeding range previously extended east to Indiana; but, it has now become a rare summer resident of northern Illinois due to destruction of nesting habitat (George 1971, Illinois Dept. Transportation 1975, Pough 1951). It is a rare migrant in southern Illinois (George 1968, Kleen and Bush 1971), and was not observed on the study area.

Capella gallinago delicata (Ord), common snipe (Vulnerable)

Common snipes breed in northern United States, Alaska, and southern Canada, and winter from southern United States to South America (Pough 1951, Robbins et al. 1966). They feed on insects, small crustaceans, earthworms, and snails in wet meadows, marshes, and bogs (Pough 1951). Common snipes are rare summer residents of northern Illinois, uncommon migrants, and rare wintering birds in southern Illinois (Illinois Dept. Transportation 1975, Kleen and Bush 1971). None was found on the study area.

Sterna forsteri Nuttall, Forster's tern (Vulnerable)

These terns breed along the southern Atlantic coast and Gulf coast, in prairie marshes of north-central United States and south-central Canada, and winter along the south Pacific, Atlantic, and Gulf coasts, southward (Robbins et al. 1966). They formerly were common summer residents, nesting along small inland lakes and ponds; presently, they are rare to uncommon migrants, nesting only in northeastern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). None was seen on the study area.

Chlidonias niger surinamensis (Gmelin), black tern (Vulnerable)

Black terns nest in inland marshes and along shallow lakes of the prairie region of north-central United States and south-central Canada; they migrate through the Mississippi valley and along the coasts to their wintering grounds in South America (Pough 1951, Robbins et al. 1966). These terns feed primarily on insects in grasslands. They currently are uncommon to common migrants and rarely breed in northern Illinois (George 1968, Kleen and Bush 1971, Pough 1951). None was seen during the sampling periods.

Asio flammeus flammeus (Pontoppidan), short-eared owl (Vulnerable)

Short-eared owls nest on the ground in open grasslands and marshes of northern United States and Canada; they winter in the southern two-thirds of the United States (Pough 1951, Robbins et al. 1966). They primarily feed on mice, insects, and birds (Pough 1951). Although short-eared owls formerly were common migrants and uncommon permanent residents of Illinois, they currently are rare to uncommon migrants in southern Illinois and rare breeders in northern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). None was observed on the study area.

Certhia familiaris americana Bonaparte, brown creeper (Vulnerable)

This subspecies breeds in northern United States and southern Canada, and winters in all but the most northern regions of United States (Am. Ornith. Union 1957). Although most nesting occurs north of Illinois, nesting rarely occurs in floodplain deciduous forests and cypress swamps of southern Illinois, southeastern Missouri, and

and probably western Kentucky (George 1969, 1971, 1972, Illinois Dept. Transportation 1975, Kendeigh 1970). Brown creepers may be extending their breeding range southward or those in Illinois and Missouri may be a distinct subspecies (George 1971, 1972). They also are uncommon to common migrants and wintering birds in southern Illinois (George 1968, Kleen and Bush 1971); however, none was observed on the study area during the spring and summer studies.

Thryomanes bewickii bewickii Audubon, Bewick's wren (Vulnerable)

This subspecies breeds in midwestern United States and winters in southern United States (Am. Ornith. Union 1957). The birds nest in tree cavities and feed on insects in brush piles, shrubs, hedgerows, thickets, and wooded margins (Kleen and Bush 1971, Pough 1951). Formerly a common breeder in southern Illinois, they presently are rare summer residents, and are declining in numbers nationally (Anonymous 1974, George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). Mengel (1965) believed their decline was due to competition with house wrens. None was observed on the study area.

Hylocichla fuscenscens salicicola Ridgway, veery (Vulnerable)

These birds nest in mature bottomland forests in southwestern Canada, north-central, and parts of western United States; they winter in South America (Graber et al. 1971, Robbins et al. 1966). Their food consists mainly of insects, fruit, and seeds on or near the ground (Pough 1951). They are rare to uncommon migrants in southern Illinois and nest in northern Illinois (George 1968, Graber et al. 1971, Illinois Dept. Transportation 1975, Kleen and Bush 1971). None was observed on the study area.

Euphagus cyanocephalus (Wagler), Brewer's blackbird (Vulnerable)

These blackbirds breed in southwestern Canada, north-central and western United States, and winter in southern and western United States and Central America (Pough 1951, Robbins et al. 1966). They feed on insects, seeds, and grain in cultivated and fallow fields; frequently they feed, roost, and migrate in large flocks with other blackbirds (Pough 1951). Because Illinois is on the eastern edge of their range, Brewer's blackbirds are rare and irregular migrants in southern Illinois and rare breeders in northern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). Nesting has declined in northern Illinois in the last few decades due to destruction of nesting habitat (Illinois Dept. Transportation 1975). None was observed on the study area.

Ammodramus henslowii henslowii (Audubon), Henslow's sparrow (Vulnerable)

This subspecies primarily breeds in north-central United States and winters along the Gulf and southern Atlantic coasts (Am. Ornith. Union 1957). These birds nest in open grasslands with dense vegetation, usually near wet areas (Pough 1951). Henslow's sparrows were formerly common, summer residents on open prairies, fields, and marshes in Illinois; however, presently they are known only to nest in Adams and Grundy counties (Illinois Dept. Transportation 1975). These birds, which are rare migrants in southern Illinois, have declined because of destruction of nesting habitat (George 1968, Kleen and Bush 1971). None was seen on the study area.

Anas rubripes Brewster, black duck (Rare, restricted, or uncertain)

Black ducks primarily nest in eastern Canada and northern states east of the Mississippi River, and winter in eastern United States. Approximately one-third of the black duck population utilizes the Mississippi flyway (Bellrose 1976). Winter inventories from 1955 to 1974 indicated a 40 percent steady and continuous population decrease which did not appear to be the result of deteriorating nesting habitat. They are fairly common migrants, uncommon wintering birds, and rare breeding birds in large marshes and potholes in northern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). They have never been a common breeding bird in Illinois (Illinois Dept. Transportation 1975). None was seen during the spring and summer sampling periods.

Anas acuta Linnaeus, pintail (Rare, restricted, or uncertain)

Pintails are one of the most abundant species of waterfowl in North America. They breed in Alaska, western Canada, and northwestern United States; approximately 800,000 winter in the Mississippi valley, with 90 percent of these in Louisiana. They feed on seeds of millet, nutgrasses, smartweeds, rice-cut grasses, and waterhemp. Winter surveys from 1955 to 1973 showed a 15 percent population increase in the United States, including a 44 percent increase in wintering birds along the Mississippi flyway (Bellrose 1976). They are common migrants, and uncommon wintering birds in southern Illinois, and rare breeders in northern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). Decreased breeding in northern Illinois probably

is due to destruction of nesting habitat (George 1971). None was seen during the spring and summer sampling periods.

Anas clypeata (Linnaeus), northern shoveler

(Rare, restricted,
or uncertain)

Northern shovelers have increased in numbers during the past 20 years while decreasing as breeding birds in central and northern Illinois due to habitat destruction (Bellrose 1976, George 1971, Illinois Dept. Transportation 1975). They nest in the northern prairie regions of United States, Canada and Alaska, and winter along the Pacific and Gulf coasts, southward (Bellrose 1976, Robbins et al. 1966). They are common migrants in Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971); however, none was seen during this study.

Aythya valisineria (Wilson), canvasback (Rare, restricted, or uncertain)

Canvasbacks nest in the prairie regions of northern United States and Canada, and winter along the Atlantic, Gulf, and Pacific coasts (Bellrose 1976, Robbins et al. 1966). Wintering populations have declined 53 percent in the United States from 1955 to 1974 due to drainage of prairie potholes and marshes (Bellrose 1976). Approximately 6,500 birds winter along the Mississippi River above Alton, Illinois; they are uncommon migrants in southern Illinois (Bellrose 1976, George 1968, Kleen and Bush 1971). While they were observed in winter on the study area during other sampling periods (Woodward-Clyde Consultants 1976b), none was observed during this study.

Oxyura jamaicensis rubida (Wilson)
ruddy duck

(Rare, restricted, or
uncertain status)

These ducks nest in emergent vegetation of marshes and potholes in the northern prairie regions, east to southern Ontario. They winter on estuaries, lakes, and rivers south to Mexico. About 55 percent of the

ruddy duck population winters in the Pacific coast states, 25 percent along the Atlantic coast, and only 20 percent in the interior of the continent. They feed mainly on vegetation, although diet varies with age, season, and location (Bellrose 1976).

Ruddy ducks are uncommon summer residents in northern Illinois (Illinois Dept. of Transportation 1975), although they may concentrate in large numbers along the Illinois and Mississippi Rivers (Bellrose 1976). Pough (1951) suggested that the ruddy duck's tameness, which makes it easy to shoot, was responsible for its enormous decline in abundance. None was observed during this sampling period.

Lophodytes cucullatus (Linnaeus), hooded merganser (Rare, restricted, or uncertain)

Hooded mergansers primarily nest in southeastern Canada and the northern Great Lake states, and winter along the Atlantic and Pacific coasts and lower Mississippi valley (Bellrose 1976). They were formerly common summer residents, nesting in hollow trees near swamps and flood-plains, and feeding on fishes, crustaceans, and aquatic insects (Bellrose 1976, Illinois Dept. Transportation 1975). Presently, they rarely nest along the Ohio, Sangamon, Illinois, Mississippi, Wabash, and Rock rivers, and possibly other areas (Illinois Dept. Transportation 1975). They are uncommon to common migrants and rare wintering birds in southern Illinois (George 1968, Kleen and Bush 1971), and have greatly suffered from the drainage of swamps and river bottoms, increased turbidity of waters in which they feed, destruction of hollow trees for nesting, and other human activities (Bellrose 1976, George 1971). None was observed during this study.

Buteo platypterus platypterus (Vieillot), (Rare, restricted, or uncertain)
broad-winged hawk

Broad-winged hawks are woodland species which breed in southeastern Canada and eastern United States, and winter in Florida and Central and South America (Pough 1951, Robbins et al. 1966). They feed on frogs, toads, snakes, insects, and small mammals (Pough 1951). While they are uncommon summer residents and common migrants in Illinois (George 1968, Kleen and Bush 1971), none was seen on the study area.

Nycticorax nycticorax hoactli (Gmelin), (Rare, restricted, or uncertain)
black-crowned night heron

These herons breed in fresh-water swamps and tidal marshes throughout most of United States, and winter in the southern portion of their range (Palmer 1962, Robbins et al. 1966). They feed at night on fishes, frogs, crustaceans, aquatic insects, snakes, and mollusks in marshes, lakes, and ponds (Palmer 1962). They presently occur statewide with a spotty distribution as an uncommon summer resident and common migrant (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). Their population has been declining as a result of land clearing, drainage, lumbering, and real estate development (Palmer 1962), and they are included on the Blue List (Anonymous 1974). None was seen on the study area.

Sphyrapicus varius varius (Linnaeus), (Rare, restricted, or uncertain)
yellow-bellied sapsucker

Sapsuckers nest in woodlands and forests of southern Canada and northern United States; they winter in southern United States and Central America (Am. Ornith. Union 1957). Their food includes inner bark of trees and insects (Pough 1951). Since Illinois is at the southern edge of their breeding range, some nesting occurs in the

northwestern portion of the state. They are uncommon to common migrants and rare to uncommon wintering birds (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). None was seen on the area.

Sitta canadensis Linnaeus, red-breasted nuthatch (Rare, restricted, or uncertain)

These nuthatches breed in northern and western United States, and southern Canada; they winter in most of the continental United States (Robbin et al. 1966). They feed on insects in the bark of deciduous trees and conifer seeds in the southern portion of their range (Pough 1951). They are rare and irregular migrants and wintering birds in southern Illinois, and possibly nest in pines of northern Illinois (George 1968, Illinois Dept. Transportation 1975, Kleen and Bush 1971). None was observed on the study area.

Vermivora chrysoptera (Linnaeus), (Rare, restricted, or uncertain)
golden-winged warbler

Golden-winged warblers breed in the Great Lake states and Appalachian Mountains, and winter in Central and South America (Pough 1951, Robbins et al. 1966). They nest in deciduous woodlands with scattered shrubby openings in northeastern Illinois (George 1971, Pough 1951). They are rare to uncommon migrants in southern Illinois (George 1968, Kleen and Bush 1971); and, none was found on the study area.

Vermivora ruficapilla ruficapilla (Wilson) (Rare, restricted, or uncertain)
Nashville warbler

Nashville warblers nest in second-growth deciduous woodlands and spruce bogs in much of northern United States and southern Canada; they winter in Central America (Pough 1951, Robbins et al. 1966). They are rare breeders in northern Illinois and uncommon to common migrants in southern Illinois (George 1968, 1971, Illinois Dept. Transportation

1975, Kleen and Bush 1971). They occurred on the study area in spring in field type 5 and woodland B (Table 7).

Oporornis philadelphus (Wilson), mourning warbler (Rare, restricted,
or uncertain)

These warblers nest in dense shrubbery in southeastern and south-central Canada and northeastern United States, and winter in Central and South America (Pough 1951, Robbins et al. 1966). They are rare summer residents along the Des Plaines River and uncommon migrants in southern Illinois (George 1968, Kleen and Bush 1971). This species occurred in woodland B in spring (Table 7).

Ammospiza leconteii (Audubon). (Rare, restricted, or uncertain)
LeConte's sparrow

LeConte's sparrows nest in tall marsh grasses in north-central United States and south-central Canada, and winter in southeastern United States (Robbins et al. 1966). Formerly a common resident in Illinois, they are now rare migrants (George 1968, 1971, Illinois Dept. Transportation 1975, Kleen and Bush 1971). It is doubtful that this species breeds in Illinois due to habitat destruction (Illinois Dept. Transportation 1975). None was seen on the study area.

Habitat Types and Their Respective Fauna

Results of trapping and census activities along transects revealed that 34 percent (157 specimens) of the small mammals were captured in woodlands, 66 percent (303 specimens) in fields. Approximately 26 percent (18 species) of the birds were seen only along the field transects, 46 percent (32 species) along woodland transects, and 28 percent (19 species) in both habitat types.

More small mammals were found in fields where food items, such as insects and seeds, were abundant offering support for higher numbers of small rodents than woodlands. Small mammals appeared to be more abundant than birds on the field transects. Reduced floral diversity in the reclaimed fields and lack of trees probably affected numbers of birds that used this habitat type. Hoffmeister and Mohr (1972) reported that mammals may be 5 to 12 times as numerous as birds in uncultivated land in Illinois.

Graber and Graber (1963) noted that bird populations were larger and more varied in woodlands where the floral and habitat diversity provided many niches. Woodlands and adjacent edge habitats were available for birds that nested in tree cavities and canopies, understory branches, and on the ground. Fewer birds were seen on reclaimed mined land. The lack of trees probably limited nesting species as only birds that nested on the ground could breed here.

Field type 1, transect IV, recently reclaimed field

Vegetation in this field consisted of legumes, annual weedy species, with cattails and a few saplings in wet areas. A pond was created in

early May at the north end of the transect. Two species of mammals, deer mice and house mice, were found here and comprised about 17 percent of all small mammals captured. Numbers of house mice increased in summer. Abundant tracks of dogs, opossums, raccoons, minks, cottontails, and deer were found in this field type; these were concentrated around the pond.

This field had the lowest bird diversity in spring, but showed an increase in summer probably due to considerable growth of vegetation and utilization of the pond by migratory shorebirds and herons. These herons used the area for feeding and probably dispersed from a large heronry on the Mississippi River near St. Louis, Missouri. Killdeer and horned larks nested in this field type and red-winged blackbirds, dickcissels, starlings, and mourning doves, which probably bred in adjacent habitats, were observed feeding or in flight.

Field type 2, transect I, reclaimed alfalfa field

Deer mice, white-footed mice, and house mice were found in this field. Least shrews were taken only along the transect. These four species comprised 24 percent of all small mammals captured. Tracks of striped skunks, dogs, opossums, and cottontails were present, although they were not abundant. A red fox and coyotes also were recorded from this field.

Due to their decreased activity and visibility, only seven species of birds were recorded from this field in summer. The absence of red-winged blackbird flocks also contributed to lower bird density in

summer. Migrating bobolinks, Tennessee warblers, and savannah sparrows were observed in spring, while horned larks, eastern meadowlarks, dickcissels, grasshopper sparrows, and song sparrows probably nested in this field type.

Field type 4, transect V, grassy spoilbanks

Three small mammal species were found on this transect. Deer mice, a prairie vole, and a house mouse were captured in spring, while only deer mice were taken in summer. Vegetation was sparse between spoilbanks and may have limited small mammals. Tracks of opossums, raccoons, and cottontails were found. Woodchuck burrows were numerous and an abandoned burrow had been used by a carnivore.

In both spring and summer, the spoilbanks had high species diversity and the second highest abundance of birds of the four field types censused. This may have been due to the ridge-and-valley topography that allowed a "greater than normal" bird population by decreasing the frequency of interactions between pairs (Karr 1968). Eastern kingbirds, brown thrashers, indigo buntings, and American goldfinches probably nested in the shrubs and trees, while eastern meadowlarks and field sparrows probably nested on the ground. A decline in the number of species seen was attributed to decreased activity and visibility of the birds in summer.

Field type 5, transect III, riverbank field

This transect had dense, annual vegetative cover with saplings along the Kaskaskia River. Deer mice, house mice, prairie voles, and

meadow jumping mice were found in spring; however, only deer mice and house mice were found in summer. Many annual plants had completed their flowering cycle and had died before August. This reduction in low ground cover may have limited prairie voles and meadow jumping mice, both of which require dense vegetation. Opossum, raccoon, woodchuck, and cottontail tracks were recorded from the sandy area adjacent to the south of the transect.

This river bank field showed the greatest density of birds of all field types censused. The majority were found in saplings; few birds were found near the levee road and sandy area. Gray catbirds, common yellowthroats, red-winged blackbirds, indigo buntings, dickcissels, field sparrows, and song sparrows were probably the most abundant nesters in this habitat. Rough-winged swallows nested in the sandy banks of the former river bed adjacent to the transect. The decreased density in summer was due to reduced numbers of red-winged blackbirds. Field and song sparrows no longer sang and were difficult to observe. Many of the indigo buntings seen were young-of-the-year.

Woodland A, transect VII, bottomland woods

This woodland was surrounded by an oxbow of the Kaskaskia River. White-footed mice and short-tailed shrews were found in both seasons, meadow jumping mice and a pine vole were captured in spring. White-footed mice were particularly abundant; 71 were captured. Evidence of raccoons, opossums, woodchucks, cottontails, and white-tailed deer was found. An eastern fox squirrel was seen in spring and evidence of beavers was found in summer.

Total density of birds remained high on this transect in summer. Fifty-two species of birds were found and included downy woodpeckers, acadian flycatchers, Carolina chickadees, tufted titmice, Carolina wrens, white-eyed vireos, red-eyed vireos, American redstarts, brown-headed cowbirds, cardinals, indigo buntings, and American goldfinches. Five species of woodpeckers utilized this woodland for feeding and most likely nested here. Seven of the 10 species of warblers observed probably nested on the area.

Woodland B, transect II, upland woods

This woodland with adjacent ponds and old field, had the highest animal diversity of all cover types censused even though a portion of it was cleared in summer for construction of a levee. Short-tailed shrews, deer mice, white-footed mice, prairie voles, pine voles, and meadow jumping mice were found on this transect, but were not abundant. Evidence of raccoons, gray and fox squirrels, cottontails, white-tailed deer, and dogs was found. Numerous bats foraged near or in openings of this woodland and probably roosted here.

This cover type had the highest diversity and abundance of birds of all cover types censused; 69 species were recorded in the woodland and adjacent old field and settling ponds. Only common yellowthroats and field sparrows were restricted to the old field area. Eight typical forest-edge species utilized both the old field and woodland: Carolina chickadee, Carolina wren, gray catbird, yellow-breasted chat, brown-headed cowbird, indigo bunting, American goldfinch, and rufous-sided towhee. A pair of red-tailed hawks was observed here and may have

nested in this woodland, as a juvenile was observed later in the summer. The diverse habitats and large flocks of red-winged blackbirds, common grackles, and brown-headed cowbirds in spring contributed to high numbers of birds seen during censuses. Yellow-billed cuckoos, downy woodpeckers, acadian flycatchers, tufted titmice, red-eyed vireos, American redstarts, and cardinals were probably the most abundant nesting birds in this woodland.

Woodland C, transect VI, upland woods

This woodland was surrounded by agricultural land, and human activity may have been a factor in the low numbers of species seen here. Short-tailed shrews, white-footed mice, meadow jumping mice, and a pine vole were captured in spring; only shrews and white-footed mice were captured in summer. Squirrel nests were found in summer along with runways of eastern moles, and tracks of opossums, raccoons, woodchucks, and white-tailed deer.

Although this transect had the lowest diversity and bird abundance of the woodlands censused, 55 species were recorded. Most birds also were found in the other woodlands, however, some migrants were observed exclusively in this woodland: least flycatchers, blackburnian warblers, rose-breasted grosbeaks, and an ovenbird. Great crested flycatchers, Carolina chickadees, tufted titmice, and Carolina wrens probably nested in tree cavities, while acadian flycatchers, blue jays, red-eyed vireos, cardinals, and indigo buntings nested in the understory. Kentucky warblers and field sparrows probably nested on the ground or in low growing vegetation.

Aquatic

Numerous ponds on the study area and the channelized river and river oxbow provided some suitable habitat for muskrats, beavers, minks, and long-tailed weasels. Insufficient food, however, probably limited permanent colonies of muskrats and beavers, while lack of vegetative cover limited the distribution of minks and long-tailed weasels.

At least 22 species of birds observed on the study area were associated with ponds, creeks, the oxbow, or Kaskaskia River. A hen mallard and two hen wood ducks were observed with broods on the ponds west of woodland B and, along with belted kingfishers and killdeer, probably nested on the area. Great blue herons, little blue herons, green herons, and common egrets may have nested on the area, but probably dispersed from the heronry on the Mississippi River near St. Louis, Missouri. Numerous shorebirds utilized ponds during their late summer migration (Table 8). Migratory and wintering waterfowl were common during colder months of the year. Mallards, gadwalls, green-winged teal, blue-winged teal, wood ducks, and canvasbacks were observed between September 1975 and February 1976 (Woodward-Clyde Consultants 1976b). Other migrating waterfowl occasionally may utilize the wetlands.

Aerial

In both seasons, numerous bats were seen foraging over woodlands, fields and ponds on the study area. Woodlands provided roosting areas for tree bats and food items were abundant over open areas and near

ponds. Planned removal of these woodlands will probably reduce or limit the number of bats roosting on the study area. Two federally endangered species (Indiana bat, gray bat) range into southern Illinois and may occur on the area; however none was captured. Big brown, red, and eastern pipistrel bats were observed.

Aerial species, primarily chimney swifts, nighthawks, swallows, and raptors, are those which spend considerable time feeding over many cover types. Common nighthawks, chimney swifts, purple martins, and barn, bank, and rough-winged swallows captured insects over the Kaskaskia River, oxbow, ponds, fields, and woodland clearings. Chimney swifts, barn swallows, and purple martins probably nested in nearby residential and agricultural lands; bank and rough-winged swallows nested on the area in banks along the levee. Common nighthawks frequently nest on open ground with outcrops or gravel, or tarred and graveled roofs (Pough 1951).

A pair of red-tailed hawks, observed north of the Kaskaskia River, probably fed on the study area, and a Mississippi kite flew over woodland B. These kites nest in mature timber along the Mississippi River and feed primarily on insects (Pough 1951, Terpening et al. 1973). American kestrels, and sharp-shinned, red-tailed, broad-winged, and marsh hawks were observed on the area between September 1975 and February 1976 (Woodward-Clyde Consultants 1976b).

Roadways and the active strip-mine

This habitat included the haul roads, levee, and other dirt roads, as well as the active strip-mine pit where identification of

animal tracks was enhanced by the lack of vegetation. Mammals observed on these areas included gray fox, striped skunk, woodchuck, cottontail, dog and cat. In addition, coyote and gray fox tracks and a mole mound were noted.

Most birds recorded in this habitat were characteristic of adjacent habitats; but, several species utilized the open areas for feeding or nesting. Killdeer were seen feeding on insects along the levee roads and in the strip pit. Horned larks were seen on bare ground, and bank swallows nested in a bank along the levee.

Implications

The selected site for the Coalcon Clean Liquid Boiler Fuels Demonstration Plant contains woodlands interspersed with reclaimed and old fields that support a diverse and abundant mammalian and avian fauna. The diversity of animals is largely a result of upland and bottomland woods which provide cover, food, and nesting and roosting areas for many species. The settling ponds and other available water provide feeding areas for shorebirds and migrating and wintering waterfowl. The variety of open field types resulting from strip-mining activities vary in stage of succession and are important feeding areas for both small and large mammals, and granivorous and insectivorous birds. Current mining operations are increasing the latter habitat types and eliminating woodlands. This reduces the diversity of habitats available to mammal and bird species, resulting in their disappearance or displacement to less suitable woodlands. If all mature woodlands are removed from the study area, bats, white-tailed deer, opossums, raccoons, short-tailed shrews, moles, squirrels, and many species of nesting birds, all of which utilize mature woodlands, may no longer be found as residents on the area in their present numbers.

Additional field habitats resulting from mining operations should allow for larger populations of certain small mammals (least shrews, mice, cottontails), granivorous birds (eastern meadowlarks, dickcissels, indigo buntings, American goldfinches, bobwhites) and other gregarious feeding species (common grackles, red-winged blackbirds) which periodically use the area.

Construction of the proposed plant in recently reclaimed fields (field types 1, 2), which are currently in early stages of succession, will affect present mammalian and avian fauna by removing at least two ponds which provide food for resident and migrating shorebirds and foraging areas for crepuscular and nocturnal insectivorous birds and bats. It also will remove the habitat which supported 41 percent of all small mammals captured, many large mammals (skunks, gray and red foxes, cottontails, coyotes, white-tailed deer) and migratory passerines. Impacts of the loss of this area will be lessened as additional, similar habitat will be created east of the construction site by future mining operations. For this reason construction of the plant probably will not have a major impact on the fauna occupying these fields.

Construction of a 110-foot wide, 8-foot deep intake canal has been proposed, connecting the Kaskaskia River to the proposed plant site. The canal, to extend from the river to the roadway, will intersect the river-bank field (field type 5). Of the fauna observed on this area, it is likely that such large mammals as opossum, raccoon, woodchuck, and cottontail will be restricted in their movements by this canal. While white-tailed deer were not found in this habitat, it is possible that some movements might be affected. It is believed that this interference will not have a major impact on the avian and mammalian fauna, as the site does not involve areas in or near heavy cover. Further, most forms may circumvent the canal by moving along the roadway as many currently do. It is possible that increased activity along the roadway, coupled with increased traffic, may result in increased roadkill of animals. Seemingly, this may be counter-acted by the animals shifting activity from the proposed plant site to more remote areas with suitable habitat.

Increased accessibility of the area will have some impact on the distribution and abundance of wildlife as animals will probably be restricted to more remote ponds, fields and woods along the oxbow of the Kaskaskia River. Increased hunting pressure on game species may result as more people become familiar with the area. But, this would not appear a problem as long as suitable habitat is available for the wildlife; and, if hunting pressure is moderate, or for that matter, is eliminated. It should be noted that evidence of hunting activities was abundant in most field and woodland habitats sampled. Other impacts of the plant may include construction of roads, discharge of any by-products or waste materials, or construction of facilities on adjacent areas, which could reduce numbers of small mammals and birds unless diverse or edge habitat was provided.

Woodland habitats offer abundant and diverse niches for mammal and bird populations (Graber and Graber 1963, Hoffmeister and Mohr 1972). Since diversity of breeding birds and raptors in strip-mined areas is greatest where striplands and woodlands merge (Karr 1968, Urbanek 1976), it would be a recommended management technique to allow previously mined areas where saplings have invaded to follow succession and provide wooded habitats. Two rare species (Nashville warbler and mourning warbler) may continue to use the area if wooded habitats are available. Settling ponds similar to those in field types 1 and 2 would continue to provide feeding areas for shorebirds and migratory waterfowl. At least one vulnerable species (little blue heron) fed along these ponds. If future ponds were located near the Kaskaskia River or oxbow, additional habitat could be provided for some mammals as well (weasels, minks, skunks).

In spite of projected losses of wildlife habitat, most of which are a result of current and planned mining activities rather than construction of the Boiler Fuels Plant, the choice of these reclaimed fields for the plant would seem to have the least deleterious impact on current populations of mammals and birds of the New Athens area. With adequate management of reclaimed fields, continued reclamation of mined areas, and maintenance of existing woodlands adjacent to the mine and along the Kaskaskia River, diversity and abundance of wildlife could be maintained.

SUMMARY AND CONCLUSIONS

The Coalcon Clean Liquid Boiler Fuels Demonstration Plant Site was studied to determine mammals and birds on the area. Most of this land has been or is currently being strip mined. Some spoilbanks have been reclaimed with plantings of grasses (Festuca sp.) and legumes. The proposed plant would be located on leveled spoilbanks that currently have sparse vegetation, primarily legumes and weedy species.

Thirty species of mammals representing 15 families were noted on the study area; 8 species in 4 families were captured in snap or can traps. Deer mice were the most abundant small mammal captured during spring and summer. These mice, as well as white-footed and house mice have been reported frequently from strip-mined lands (Layne 1958, Verts 1959, Yeager 1942). Absence of dense grassy areas probably limits the distribution of pine voles, prairie voles, and least shrews.

Diversity and abundance of small mammals varied seasonally and between cover types. Reclaimed fields, particularly alfalfa fields, supported large numbers of small mammals. Numerous weedy species of plants invaded the fields and probably provided additional seeds and cover to enhance small mammal populations. Urbanek (1976) reported that floodplain forests on unmined land provided the least diverse small mammal communities. Our results are not consistent with this, as in spring, bottomland woodland A had high small mammal diversity. In summer, however, only two species were recorded from this woodland.

The reclaimed strip-mined lands adjacent to more mature woodlands provided ideal habitats for tree bats. Because woodlands were available for roosting, scattered ponds and open fields were ideal feeding sites on the study area. Numbers of bats declined in summer probably due to clearing of trees and increased human disturbance in woodland B. Two species of endangered bats may occur on the study area, but were unreported.

Large mammal censuses revealed opossums, raccoons, woodchucks, cottontail rabbits, white-tailed deer, and dogs were abundant in mined and unmined habitats. The diverse fields and woodlands, as well as abundant water provided food, cover, and nesting areas for many of these animals on the study area. Coyote, mink, long-tailed weasel, gray and red fox numbers probably were low although prey species were abundant. Squirrels were limited by the scarcity of mast-producing and denning trees. Beavers and muskrats periodically used the area, but colonies probably were limited by insufficient food supply (Arata 1959, Verts 1959).

Presence of 121 bird species representing 33 families was recorded from the study area; 109 species were observed in spring and 81 in summer. Many summer and permanent residents presumably bred in the area; nests or fledglings of 15 species were found. Many migrating birds also utilized the area. Bird diversity was lowest in early-successional types of habitats and greatest in late successional habitats. Species of birds found on strip-mined land were consistent with other studies in the midwest (Brewer 1958, Jones 1967, Karr 1968). Two

"vulnerable" bird species (Mississippi kite, little blue heron) and two species of rare, restricted or uncertain status (Nashville warbler, mourning warbler) were recorded from the study site.

Construction of the Coalcon Clean Liquid Boiler Fuels Demonstration Plant will eliminate aquatic and field habitats which supported large numbers of small mammals, bats, large mammals, nesting and migratory birds. The selection of reclaimed fields for the plant site will lessen the impact of construction if additional similar areas are provided. Loss of woodlands due to mining will have a greater effect on diversity and abundance of mammalian and avian species than construction of the plant. Animal populations may be maintained if ecological succession of reclaimed fields is permitted, and if woodland habitats are maintained within or adjacent to these fields.

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